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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

TWENTY-FIFTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

GENERAL ANNOUNCEMENT.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
MONTCLAIR, N. J., Sept. 13, 1897.

There will be an annual meeting of the American Gas Light Association held in Old Point Comfort, Va., on October 20, 21 and 22, 1897

The meeting will be called to order by the President, Mr. Chas. H. Nettleton, of Derby, Conn., at 9:30 o'clock A.M., Wednesday, October 20, in the meeting hall of the Hotel Chamberlin, the headquarters.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in so doing a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The Chamberlin is conducted on the American plan, and the rates will be as follows: $3 per day for single room without bath; $4 for single room with bath; $3 for each person, in double room without bath; $4 for each person, in double room with bath.

The Hygeia Hotel, directly across the street from the Chamberlin, gives the same rates.

The meeting hall will be the dancing hall of the Hotel Chamberlin; thus the headquarters and the hall will be in the same building.

The Roll Call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of Application for Membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the Secretary's hands by Oct. 10, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at this meeting is as follows:

"Some Further Experiments on Interior Illumination," by Mr. Alten S. Miller, Long Island City, N. Y.

"Chemical Notes on Purification," by Mr. Henry A. Mather, Brooklyn, N. Y.

"Gas Advertising," by Mr. R. M. Searle, Atlanta, Ga.

"A Report on Burner Stoppages," by Mr. Paul Doty, Long Branch, N. J.

A paper by Mr. K. M. Mitchell, St. Joseph, Mo., giving an account of a method successfully employed by him to obviate trouble from naphthaline.

"A Quadruplex Purifying Box: Why Not?" by Mr. F. H. Shelton, Chicago, Ills.

"Iron Rust in House Pipes," by Mr. F. B. Wheeler, Long Branch, N. J.

In addition to the above the following topics will be brought in for discussion by short written introductions:

"Leakage."

"An Experience in Oil Storage."

"Notes on Main Pipe Laying."

"How can we Extend the Use of Gas for Culinary Purposes beyond the Heated Season?"

All questions for the Question Box should be sent in to the Secretary as soon as possible, in order that they may be printed in the next circular before the meeting, thereby insuring their discussion.

During the days of the meeting all announcements will be posted on the Bulletin Board in the meeting room. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the Year-Book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given, that if any of the speakers at the meeting desire to correct their remarks in discussions before they are printed, they will be given an opportunity before leaving Old Point, but *not* after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the

meetings, and all those who desire to correct their remarks *must* notify the Secretary at the close of the session at which such remarks are made, as all the report will be turned in to the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted (viz., full fare going and one-third fare returning by the same route), by the several Passenger Associations named, and under the conditions noted.

The Trunk Line Passenger Committee, covering territory west of New England and east of Niagara Falls, Buffalo and Salamanca, N. Y.; Pittsburg, Pa.; Bellaire, Ohio; Wheeling, Parkersburg and Charleston, W. Va.

The New England Passenger Association, covering nearly all of the lines in the New England States.

The Southeastern Passenger Association, covering the territory south and west of the Virginias, and south and east of the Ohio and Mississippi Rivers.

The Central Passenger Committee, covering the following grounds: Bounded on the east, by Pittsburg, Salamanca, Buffalo and Toronto; on the north, by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook County, Illinois; on the west, by the west line of Cook County and the Illinois and Mississippi Rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio River, including points on either side of that river.

The Western Passenger Association, covering the territory west of and not including Chicago, Peoria and St. Louis—in other words, the territory west of that of the Central Association—have refused to grant the rate. Members from this territory should buy tickets from starting point to the nearest or most convenient point in the territory of any of the Associations granting the reduced rate, and at such point purchase tickets through to Old Point Comfort and obtain a certificate.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations.

First.—The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

Second.—Each person, to obtain the excursion rate, must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

Third.—If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where each purchase is made.

Fourth.—Tickets for the return journey will be sold by the ticket agent at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

Fifth.—No reduction of fare will be made on the return passage, if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points, to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

Sixth.—Certificates are not transferable, and return tickets secured upon certificates are not transferable. The transfer of any such is liable to prevent the securing of reduced rates for future meetings.

Seventh.—The certificate of agent at starting point, duly endorsed by Secretary of Association, must be presented to ticket agent at place of meeting, within three days (*Sunday* not reckoned, except by Southern Passenger Association), after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

Eighth.—No refund of fare will be made on account of any person failing to obtain a certificate.

The Old Dominion Steamship Company have also granted a round-trip fare of $10 from New York to Old Point. This includes stateroom and meals both ways.

SPECIAL.

Be sure to obtain a railroad certificate when buying your ticket for Old Point, as the greater the number of certificates handed in the easier it is to get the reduction in rates next year. Apply for ticket and certificate at least 30 minutes before train time. Each person must sign his own certificate at time of purchasing ticket for Old Point. Be sure to have the Secretary endorse your certificate at Old Point as soon as you get there. Apply for return ticket at least 30 minutes before train time, and have your certificate with you. Any person, ladies included, attending the meeting, is entitled to the reduced rate from the territories named. Members will please hand their certificates to the Secretary, or his clerk, upon arrival at place of meeting. If there are 100 members present, holding certificates, each certificate will then be properly endorsed and handed back to owner, before adjournment.

If a sufficient number of subscriptions are obtained there will be a banquet at the Hotel Chamberlin, Thursday evening, October 21, and an excursion on the waters of Hampton Roads and the James River, on Friday, October 22. Tickets admitting member to banquet and, with ladies accompanying him, to the excursion can be had for $5. If you wish to join in these entertainments please sign enclosed card and mail it to the Secretary at once. It will be necessary to have at least 100 subscriptions to make them successful.

ALFRED E. FORSTALL, Secretary.

Extracts from the Constitution.

SEC. 12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.

SEC. 51. No member who owes two years dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.

SEC. 52. Any member whose dues shall remain unpaid for a term of three years, may be dropped from the roll of membership by a vote of the Council.

BRIEFLY TOLD.

OBITUARY NOTE, MR. FREDERICK W. NORTON.—With real sorrow, intensified by the hard fact that deceased stood only on the threshold of manhood, so far as that state may be reckoned by mere years, we have to chronicle the death of Mr. Frederick Wellington Norton, who died at his home, Courtland street, Nashua, N. H, on the afternoon of Saturday, October 2d. A worthy son of his much respected father—the late Hon. A. M. Norton, whose administration of the affairs of the Nashua Gas Light Company was sufficient not only to hold the confidence of the proprietors of the property, but to arouse the admiration of his fellow gas managers of the Eastern States—his untimely taking off appeals with double force to those who, having known the father, esteemed the son, since the latter's way in life was modeled on the former's upright methods. The story of the dead man's life is easily told; for in it there was no romance, no disconnection—just a history of work well done entrusted to him, and terminated in a span all too brief. Frederick Wellington Norton, who was the second child of the Hon. Alfred M. and Leona Norton, was born in East Boston, Mass., November 17, 1868, and in his fifth year, accompanied his parents to Nashua, N. H., where his father had been named to the position of Superintendent of the Nashua Gas Light Company. His education was obtained in the Nashua High School, from which institution he graduated with the Class of 1886. Shortly after his graduation he was employed in a subordinate capacity in the Company managed by his father—the corporate title of which for some years has been that of the Nashua Light, Heat and Power Company—and for the ensuing six years the youngster thoroughly mastered the details of the gas business. So well, indeed, had he fostered his opportunities that, on the death of his father (July 13, 1892), he was appointed to the Superintendency of the gas division of the Nashua Company's business. To that responsible post he held with profit to his employers and with credit to himself. He was an active member in the New England Association of Gas Engineers, in the Guild of Gas Managers and in the American Gas Light Association; and his best allegiance was always at the command of the named Societies. It is of record that he was prominent in the Masonic circles of the city, where his commanding presence and manly ways always attracted attention and insured him genuine popularity. He was united in marriage, October 25th, 1894, to Miss Almira Whithed, who survives him. The funeral services were held on the 5th inst., the Reverend Francis A. Gray, of the Universalist Church, assisted by the Reverend James Goodwin, Rector of the Church of the Good Shepherd, officiating. The mourners included many prominent representatives of the gas industry in New England, and the body bearers were four of the men who served under deceased in the gas works. Interment was made in Edgewood Cemetery. A local paper, in closing its accurate notice of the life of deceased, thus commented on his personality: "It is not too much to say that Mr. Norton was one of the most popular young men in this city. In his commanding form and quiet, unobtrusive deportment, he resembled his lamented and lovable father; and in all his ways he was the kindly disposed gentleman who was ever anxious to minister to the happiness of those about him. Surely, in his early death Nashua loses a citizen who gave promise of usefulness along many lines of endeavor."

NOTES.—The United Gas Company, which has succeeded to the estate of the Darby Gas Company, of Delaware county, Pa., has also absorbed the right to supply gas in the boroughs of Colwyn, Yeadon, Fernwood, Lansdowne, Clifton and Aldan.——The Nashville (Tenn.) *Sun* says it is by no means assured that the shareholders will indorse the recommendation of the Directors that the $140 per share offer by the syndicate shall be accepted.——After an active connection with the Oregon Iron Works of 42 years, Mr. Jas. R. Floyd has retired, and the business will be carried on by his sons, Messrs. Frederick W., Henry E., and Jas. R., Jr.

The Sale of Sulphate of Ammonia.

By Mr. Norton H. Humphrys, in the *Journal of Gas Lighting.*

The low prices current for this residual during the spring aud summer have not attracted so much attention in gas circles as one might expect; and the reason is not far to seek. In most cases the low return under the heading of "Sulphate" is the only unsatisfactory feature in a fair and prosperous state of affairs, as exhibited by the statutory statement of accounts. Coal and other materials have been moderate in price. The demand for gas—thanks to the good offices of slot meters and incandescent burners—shows a steady and substantial increase. Tar is better; and coke is looking up. In the midst of so much genuine cause for congratulation, it is a natural thing to look indulgently on the sulphate item, and to accept it in a matter-of-fact philosophical sort of spirit. We cannot expect everything to wear a rosy hue, and should be grateful that there is nothing worse to bear. This appears to be the prevalent tone at shareholders' meetings, and the question of the means adopted for the advancement of other manurial agents, though to some extent at the expense of sulphate, and the various tactics in the way of rigging the market with a view of making a good thing in this particular article—in respect to which we must remember that neither producer nor consumer, to use an Americanism, comes in at the divide—has been regarded with comparative indifference, so far as the gas industry is concerned.

But sulphate of ammonia is also a product in connection with other branches of applied chemical engineering, and as such appears to take a more important position than it does in the eyes of the gas engineer. The makers are not inclined to stand on one side and see sulphate crowded out of the market without a show of resistance. While the gas engineer, in many instances having other more pressing matters claiming his attention, is inclined to sell at any price buyers like to offer—a fact that has been used to his disadvantage—we find that others are devoting some attention to the intrinsic value of sulphate, the reasons that have led to the depression of the market, and generally to the why and the wherefore of the whole thing. The same has been done, in a more or less spasmodic manner, in connection with the gas industry from time to time, but has been dropped because no one seems to have time to properly handle it. The results of this later inquiry are the same as in former cases. We are again told that ¾ cwt. of sulphate is equal in manurial value to 1 cwt. of nitrate; that it is not so soluble in water, and will not be washed into the ditch with the first rain; and that it is not deliquescent, and is therefore well adapted for use as the nitrogeneous element in the preparation of fertilizing mixtures. To this might be added a feature that would attract more attention in any other country than our own, but which nevertheless should be appreciated by all interested in the general commercial prosperity. While in other lands the manufacturer of a home product is encouraged, and can look to his government for support in many ways, in England he is a kind of football, to be kicked about and worried by tax and rate collectors, inspectors and railway companies; and the same feeling spreads to purchasers in need of his commodities. It has been proved over and over again that the bulk of the sulphate made in this country ought to be delivered directly into the wagons of neighboring farmers, and that the cost of cartage incurred on it need be no more than is sufficient to convey it into the next parish. But the fact of the market prices, and of our dependence upon foreign users who are beginning to find that supplies can be obtained nearer home, remains with us. Once more is surprise expressed that the German or the French agriculturist should be willing to pay the carriage on a product that the British farmer does not care about, although manufactured at a works within a stone's throw of his own door; and there is a general impression that something ought to be done in the way of remedying such a state of affairs.

The prevailing idea seems to trend towards a kind of Central Committee, who should publish suitable literature, offer prizes for essays, encourage experiments of a practical nature, and generally advertise the thing. Something has already been done under the first head, and several pamphlets or leaflets have been published for the use of makers. So it is pertinent to ask: "Is the issue of pamphlets sufficient of itself?" Also: "Is it the best plan to issue the same by post or otherwise, from the office of the gas company?" We must consider whether it is consistent with the farmer's customs and methods of doing business to expect that he is to be influenced by this means. To begin with, the pamphlet form of advertising is so largely used now that the sulphate leaflet runs a chance of being smothered amid a host of others. Few of us could honestly say that we take every pamphlet left by the postman at our door, and carefully peruse and digest it from the beginning to the end. Without any great stretch of imagination, we may suppose a farmer sitting down to peruse a sulphate leaflet—probably at a time when he is too much used up with regular work to bestow a fair amount of attention upon it—and after a casual glance at its contents, casting it aside without further thought; regarding the experiments quoted in the same light as the average householder looks at the scientific (?) facts in a patent food or universal medicine circular. Again, let us put the collar on the other horse, and suppose that a gas engineer receives by post some leaflets sent by a farmer, dealing with some agricultural residual that is applicable for purifying gas, and quoting practical experiments, together with some practical advice. Might it not have a similar effect to that exercised upon a wealthy and successful farmer, who cast a sulphate leaflet into the fire after perusal, with the remark that he had farmed for 30 years and knew what manures to use without taking the advice of a gas company in the matter?

There is a modern type of farmer coming on with the rising generation, who has been through his courses at a college of agriculture, and understands analytical chemistry and the constitution of soils and manures. But the average agriculturist is steady-going and old-fashioned; having a sturdy scorn for new-fangled notions, and not likely to be of a pamphlet-reading turn of mind. A common feature of the regular newspaper testimonial is the statement that the writer's attention was first attracted by "reading your pamphlet;" but I question whether many gas companies can say the same in connection with the sale of sulphate. The part played by instructive literature is secondary, rather than primary. Sell the farmer a sample lot of sulphate *first*, and then the chances are that he will accept and study the leaflet, which previously he had cast aside in a casual way. I would also question whether attempts to combine advertisements with instruction, in the shape of a pamphlet indorsed with the name of the vendor in bold type, or with prices, are a success. The fact of a man having "something to sell" does not increase one's confidence in his utterances: and, in a similar manner, the glaring advertisement is likely to detract from the value attaching to the contents. If it is decided to issue pamphlets, they should be anonymous, or at any rate carry nothing further than "With the ——— Gas Company's compliments." The pamphlet is a useful servant in connection with the second or following orders, but not of much use as regards the first.

But suppose that one of the arrows shot at a venture, in the shape of the pamphlets sent out by the medium of Her Majesty's mails, happens to hit the mark—that the farmer reads the pamphlet and is impressed by it. We are repeatedly told that the average agriculturist knows very little about the composition of manures, and depends to a greater or less extent upon the advice of the vendors of artificial fertilizers. What is more likely than than that he will take it to the agent or representative from whom he is in the habit of purchasing manures and feeding stuffs, and ask for his opinion. The salesman has not had sulphate put upon his list of wares. He has heard casually that people go to the gas works to buy it; or perhaps he finds on the front page of the pamphlet the announcement, "To be obtained of the ——— Gas Company." As a business man, his mind naturally leans to the little commissions which he has turned over on the querist's orders from time to time, to the fostering and increase of which his energies are directed; and his reply is more likely to tend towards getting an order for one of the items entered on his own trade list, than in the direction of inducing the customer to send elsewhere for some sulphate. And if, while booking the order, he makes a witty reference to "chemical stuff," or "gas works refuse," we need not be surprised.

A great deal is said about the success of a certain committee in connection with nitrate of soda. No doubt they have freely advertised it, boomed it, kept together a connection, and added thereto. But I question whether they have secured many direct orders. This is an important point, and the distinction between the two must be carefully made. I do not think that any committee will be likely, by means of pamphlets or otherwise, to influence direct sales from producer to consumer, to anything like a general extent. A small proportion of business may be thus obtained, but the bulk will continue to be done over the counter at the shop, or at the desk of the agent who attends regularly at the market. Without doubt the prize essays, the advertisements direct and indirect, and the pamphlets have all assisted in keeping nitrate well in front of the agricultural public. I do not decry the value of these means, but regard them as crutches rather than as main supports. The general opinion seems to follow the idea that the vendors may go thus far, and then sit down and wait for orders to drop in.

But turn for a minute to the actual way in which business is done. It is market day, and the farmer arrives at the usual hour and at once proceeds to buy and sell stock or produce. This occupies him up to the time of the 1 o'clock ordinary. After dining he has a quiet chat with

his neighbors about business and other matters, but chiefly business. At this period he may possibly hear something about sulphate. He decides to try a sample lot, and goes out to buy some. There is a man round the corner who will book orders for several other manures; but it is not likely that he knows anything about sulphate. The would-be buyer may search the market through without being able to place his order—and yet a stock of some hundred tons is held within a few miles. This is not fancy, but is founded on actual fact. For 10 years a farmer who attended market regularly, and knew all that was going on, was accustomed to send 50 miles for supplies of sulphate, and actually did not know that it was on sale within 2 miles of his farm. Only recently a well known professor of agriculture, in the course of a technical magazine article, referred to sulphate offered at £7 10s. as too cheap to be genuine. Another farmer was under the impression that sulphate was listed at about £15, and on being told that he could get it for less than £10, he at once cheerfully placed a large order, and wished he had known it before. These are plain facts, and several more of like kind could be quoted.

I do not deny that well written leaflets or pamphlets—not too prosy, not too long and not too scientific—have secured some business, and especially if based more on the lines of popular advertising than on a chapter or extract from a heavy science work of eight or nine volumes. But this quasi-scientific preaching at the farmer, which has been conducted off and on for some time now, will never reach the bulk of pos sible purchasers. The seller of sulphate must come down from the platform, where he has been talking well over the heads of the majority of his audience for some years past, and go in and out among the agriculturists. Sulphate must get before the farmer's observation in the regular business way, for farmers, more perhaps than any other class, like to follow their established habits and traditions. It must be quoted on all the trade lists, and be present in every box of samples. Placards relating to it must get in among the colored prints of enormous carrots, gigantic turnips and Brobdignagian swedes that embellish the walls of the seed and artificial manure shop; and the pamphlets may be at hand on the counter for the use of all who want them. Agents of experience and influence, knowing when and how to approach the purchaser, must be at every corner of the street, sitting at the table of every market ordinary, in the smoke room at the farmers' club, at every horse or cheese show, at the exhibition of agricultural implements, and everywhere else where there is a chance of getting orders. *This is the secret of the success of nitrate.*

Further, I prefer to utilize the experience of existing agents—wherever it is available—rather than send out new ones, who must necessarily be under a disadvantage as compared with those who know the ground. There is no occasion for the sulphate maker to sit, like Micawber, waiting for something to turn up in the shape of some wonderful committee that, after being pulled this way and that amid a multitude of counsellors, will come out in grand form and do the whole trick for him. Let the disconsolate holder of a large stock arm himself, first, with a fair analysis of his product, made by some leading professor of agriculture or analyst, who is well known and regarded as an authority in the district that is to be exploited. This, by the way, is a helpful course under any circumstances. A few copies should always be at hand in the rental office. The next thing is to obtain copies of published pamphlets or leaflets and to put up a few neat sample bottles. A morning's work on a quiet day, using the word from the agriculturist's point of view, will do the rest. Thus prepared, he selects a few of the leading agents in the neighborhood, interviews them personally, putting the matter before them in the usual business way. The analysis, the samples and the literature are all discussed, the agent's opinion is taken on the matter of advertising, and so on. Arrangements are made for the supply of placards, pamphlets with trade address, etc., as may be required. The exact course to be taken must vary according to local circumstances. Perhaps an advertisement giving a list of dealers may be inserted in the local paper. But while the means may differ, the end desired is the same. We want, through the medium of the agent, to get close to the farmer in a business-like way, at business hours, and in accordance with his particular habits and ways of doing business. In this manner a local connection may be established that will relieve the maker from any anxiety respecting market prices and stocks.

But this is in addition to, and not as a substitute for, the work of the Central Committee. If every maker of sulphate was to act on this advice, the need for the Association would not be reduced one iota. On the contrary, a demand for pamphlets, for literature, and for the results of experiments would be created. Where the prize essay, if published to-day, would find one reader, it would then find one hundred. I can even imagine that a well written text book, embracing the gist of the published information, would find a ready sale. If anything, double the subscription to the Association, and do not think of dropping it.

[Translated for the JOURNAL, by Mr. Herman Poole, F.C.S.]

Burners and Mantles for Incandescent Gas Lighting.

By MR. A. BANDSEPT, Brussels, Belgium.

Through the courtesy of the author we have received a copy of his pamphlet on "Burners and Mantles for Incandescent Gas Lighting," and although much of the matter has heretofore appeared in a fragmentary way in our columns, the consecutive chapters of the story, as told by Mr. Bandsept, are nevertheless so well worth preserving in the permanent record that we herewith reproduce them in full:

With low pressures Bunsen burners take barely one-half the quantity of air needed for a good combustion of the gas; the other half is obtained from the surrounding air. To increase the draft recourse must be had to special arrangements, and we must work with injectors having a gradually contracting opening causing a strong jet, thus drawing in the air at different portions of the path travelled. In this manner the gas attains a mean strength with the smallest loss of force.

The mixture thus made should be kept from disintegration, and made perfectly intimate at the instant it passes to the burner opening. From that time the flame is fed by elements always ready to enter into combination and its temperature reaches a maximum. As it rises in the burner the gas becomes heated, consequently the body of the jet should be enlarged at its upper portion. As this expansion has the effect of loosening the bundle of fluid veins running side by side, it becomes indispensable to revivify the mixture when it enters the flame.

The successive portions of air drawn may be arranged along the length of the burner tube, or may be superposed at its base and set at different angles, so as to cause the interweaving of the gas and air.

As for the spreaders placed at the opening of the jets, they are composed of plates with intercrossed meshes, perforated plates giving rise to multiple and opposite jets, which break up each other, spirals with convolutions to the right and to the left being intended to cause a whirlpool movement, etc.

All these burners, amply fed with air, are capable of giving solid flames in which the interior cold portion disappears entirely and which need only a small quantity of air to be complete when covered by a hood. This is then not exposed to cooling, as with ordinary burners, and the luminous yield is better.

The flames keep full when the combustion opening is a circle. They become hollow when the top carries a thin shield allowing only an annular passage. This shield is terminated by a conical point projecting into the interior of the diverging tube and which enters into the gas column to direct it smoothly towards the outlet. The section of the latter is calculated from the volume of the mixture, and the kind of flame. It should never be reduced to the point of causing a hurtful resistance to the work of the injector.

We may develop the flames tulip-shaped by attaching to the burner extremity a capsule with perpendicular and lateral slits, with the point turned equally towards the base.

Burners vary with the section of the mantle. The last must necessarily bathe in the external zone of the flame, where the combustion occurs in presence of external air and of oxygen rendered free by the course of transformation taking place in the body of the refractory material.

Long and truncated cone mantles are better acted on by full elongated flames, while shorter cylinder mantles need inflected flames.

Then, the burners should furnish a combustion proportional to the specific resistance of the mantles, which depends on the nature and density of the impregnating fluids, the thickness of the tissue and the method of incineration.

For example, in applying the two kinds of burners just mentioned to two different mantles—one cone shaped, of thorium and cerium, the other, cylindrical, of aluminum and chromium, we find: That the full flame burner (Fig. 1) increases about 30 per cent. the yield of the first mantle, but does not aid that of the second; while the burner with an inflected flame (Fig. 2) increases in a like proportion the luminous yield of the second mantle, and shows no marked influence on the illuminating power of the first.

This is explained as follows: In the first case, the elongated flame does not strike the straight walls of the mantle forcibly enough, and a portion of the gas escapes without producing a useful effect; then the same flame is entirely caught by the other mantle, whose inclined walls,

joining at the top, oppose a certain resistance to the gases and oblige them to adhere more to the light incandescent tissue. In the second case, the flame driven laterally penetrates the strong tissue while making the final combustion. But, inflected in this manner, the flame cannot reach the point of heating a longer mantle for its full length. As, in the example chosen, this is more sensible to calorific actions, the surplus of activity spent at the base does not compensate for the loss of light experienced higher up.

Whatever the section of mantle adopted, the opening at the top will be such that at the interior the pressure of the gases remains sufficient to keep all portions of the tissue in contact with the extreme zone of the flame. This precaution is recommended because it is the upper portion of the flame that develops the most heat. Still, the mantle should never be completely closed at the top, as otherwise the mixture will burn only on the outside.

In actual manufacturing it seems quite difficult to realize mantles of absolutely regular shape. Progress would be made, without any doubt, by impregnating the tissue in a complete manner by means of concentrated solutions, thus diminishing the shrinkage during incineration. By effecting the last, under pressure and temperatures much higher than those it will be subjected to in actual use, the mantle will not shrink any more and will keep its form quite well. Similar methods allow also the correction of the mantles of certain inferior kinds for short life.

A deep and regular impregnation of the tissues is obtained best of all by atomizing; not by surfacing a skeleton by means of oxides reduced to a very fine state of division, but by the injection into the tissues of the fluids as little diluted as those actually used. In this way we are led to the use of solid illuminating bodies very finely pulverized, which plan offers advantages on all sides.

The quantity of air drawn by the injectors evidently increases with the pressure of the gas. When this pressure reaches a certain limit the successive accessories of air are no longer indispensable. Yet the atomizer should be calculated for the pressure if we wish the flames so produced to act without destructive effect on the mantle.

Sometimes a large part of the initial force is utilized in a quick application of heat on hard mantles, incinerated at a forced rate. This way is put forth for the intensive methods of incandescence which are in vogue at this time.

The compressors should deliver after the completion, and at a constant pressure, otherwise the mantles will be submitted to an intermittent heating which rapidly wears them out. Now, this invariable

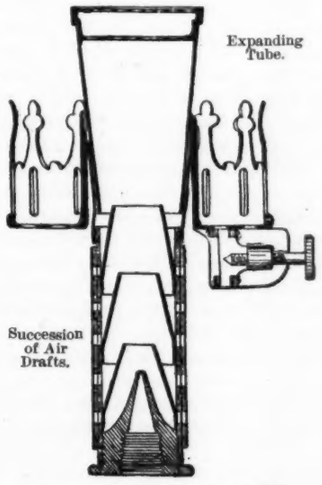


Fig. 1.—Burner of the First Kind.

accompanying depression and the proportional delivery are always easy to establish, as experience has demonstrated.

The luminous explosion of forced jets causes part of the strain exercised on the mantle to be exerted in some way by the layer of compressed gases. These last circulate more freely in the web of oxides, and shape the meshes. But the role put on the mantle is lessened a little in presence of the great calorific intensities used. Also, with good mantles and burners well devised, we succeed in producing luminous effects comparable to those with forced jets, and without exceeding 70 millimeters (2¾ inches), and with a consumption of 300 liters (10.6 cubic feet) per hour.

Whatever method be employed, if the pressures become too great the gases spread through the meshes of the mantle and oppose the normal accomplishment of the final reactions in the incandescent body.

In short, the incandescence is not so much a function of the heat of combustion as of the the temperature. Yet it should not exceed a certain degree, inasmuch as the oxides emitting the light remain necessrily the seat of the final combinations. A perfect combination made in

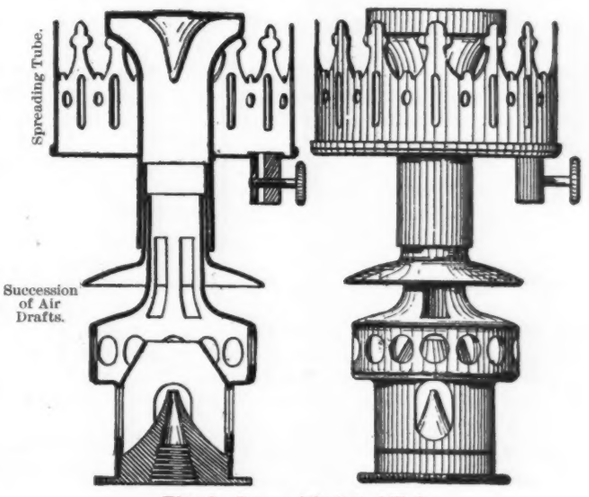


Fig. 2.—Burner of the Second Kind.

the interior of the mantle would not have for result the increase of luminous yield; it would, on the contrary, lower it. Besides, the flame of the incandescent burner is reducing. It is complete only when its elements penetrate into the oxides and are condensed there, or while they draw their oxygen, on account of the increased chemical affinity under the influence of the high temperatures.

It is to be presumed that the oxygen necessary for the final reactions of the flame products is first added to the portion adjoining the principal body, forming the nucleus of the illuminating molecule. This subtraction of oxygen, in the external portions, causes a displacement of the same element at the surface of contact of the two oxides and a settling of the central layers. So that the molecule is condensed by augmenting the quickness of rotation, and, consequently, it draws into its new sphere of activity the atmospheric oxygen which has taken the place of the products drawn from the combustion of the gases. This oxygen thus absorbed causes the spheriod to regain its primitive dimensions while slackening its gyratory movement. Consequently the two phases of the reciprocal action at play in the phenomena are resumed in a rapid pulsation which is repeated to incalculable degree in a very short space of time. By the presence of molecules in the immediate vicinity, similar to that of which we have just analyzed the conditions and affected in a manner identical, the pulsations unite and generate waves which constitute the luminous rays.

Summing up, the oxygen leaving the thorium-cerium compound to perform the final reactions with the flame products, is replaced by atmospheric oxygen already endowed with a certain quantity of energy, and which, after occlusion in the molecular interstices of the cerium, enjoys, on its departure, properties comparable to those which characterize the nascent state.

If we admit that the phenomena take birth in the molecular pores of the exciting matter, that is to say, that the exterior oxygen and the gases of the flame unite there to form the normal products of combustion, the heat thus developed would have the effect to impart a vibratory movement to the ultimate particles of that matter, a movement which in its turn would generate light; or the rare oxide is reduced by the hydrogen and the carbonic oxide, and then reoxidized by the oxygen of the air at a high temperature, with emission of light corresponding to the entrance of oxygen into the body; or there is a superficial absorption of the gases, which thus condensed gives an intense combustion and a molecular vibration.

The transformation of movement in the two routines being never absolutely completed, there results a gradual changing in the condition of the body itself, which in a certain time causes it to lose its emissive power. Whichever explanation we admit, there remains that the man-

tle, in virtue of the law of maximum work, contributes to increase the chemical affinities engaged in the system—another reason for not forcing beyond measure the action of external heat.

Mantles of platinum and its allied metals, while they are rendered very porous and light, show strongly the property of provoking and exhausting the combinations which lead to incandecsence. By employing sufficiently long burners, with air openings arranged at the lower end, we succeed in giving a fine lighting with ordinary city pressures. But the duration of these mantles diminishes with their illuminating value.

According to what precedes, the luminosity of a mantle requires an oxide sufficiently stable, and a smaller quantity of another oxide, causing a variation in the degree of oxidation ; the two should not in any case react as acid and base.

We have seen that the adjacent bodies play the role of transmitters of oxygen. They solicit the final reactions of the flame by yielding to it the necessary complement of oxygen, which combines in the nascent state and then incorporate an equivalent quantity of the same element drawn from the ambient atmosphere.

The advantage of thorium as a base comes from its great porosity and its low calorific capacity. By incineration of nitrate of thorium it forms with intumescence an excessively light and divided residue which incloses the particles of oxide of cerium when the mantle is used up.

The catalytic matter is found in some way suspended from a support. If it is spread on it in definite proportion, it aids to the utmost the calorific actions at work in the system.

Among the rare oxides, cerium is that which best induces occlusion of gases. Its efficacy is more marked at high temperatures than at low ones.

The emission of light depends on the rapidity with which the body takes the temperature of the flame. This quality is in relation to the fineness of the matter and to its resistance to fire. All bodies sufficiently fine and refractory become radiant in the Bunsen flame.

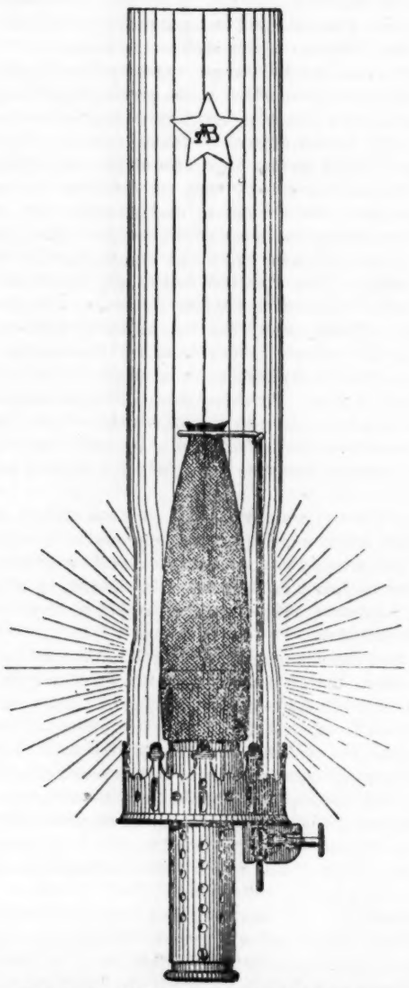
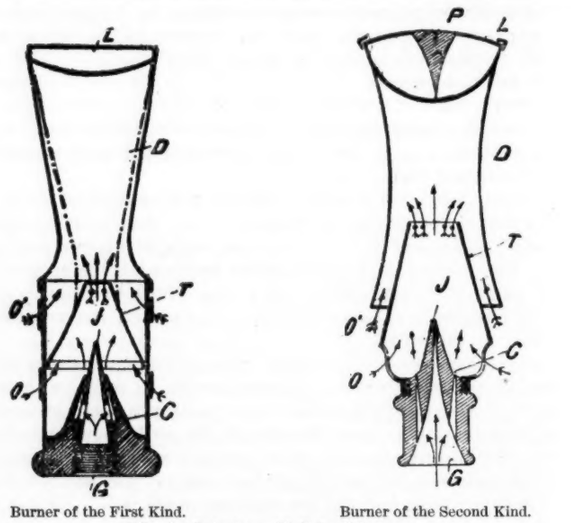


Fig. 3.—Incandescent Lamp with Bandsept Burner.



Burner of the First Kind. Burner of the Second Kind.

Fig. 4.—Injectors with Jet and Crown.

The Bandsept Burners.—The first burner mentioned (Fig. 1) is substantially composed of an injector determining the best suction of air for a given pressure, and serving to force back the gases through an atomizer intended to cause their intimate mixture. The injector is formed of a jet opening inside a series of conical tuyeres of increasing cross section and surmounted by a diverging tube. These tuyeres are fixed in the body of the cylinder, which may be open or pierced with holes.

The illuminating gas enters the apparatus by the injector jet with a gradually contracting opening intended to impart the greatest possible velocity just at the entrance to the tuyeres. In proportion as the jet is raised in the series it draws the air with it, and each element, or truncated cone, of such series contributes to the formation of the mixture by its own aspiration and the consequent vibrations which are caused in the ambient gases. The mixture is then completed gradually, so as to penetrate the meshes of the atomizer with all possible force, where it is thoroughly mixed.

By turning the obturator ring we may open more or less the orifices superposed in the body of the jet, and thus vary the total quantity of air admitted.

When we push the admission of air to saturation of the gas we see a thin, clear, blue segment above the last sheet of the atomizer, which forms the base of a violet, chemically homogeneous, flame. At this instant if we still increase the air supply the pellicle undergoing the chemical transformation passes into the burner, without, however, drawing in any flame. On the contrary, if we gradually reduce the air supply the blue segment reduces to a point and the zone of formation increases more and more, at the expense of the external portion of the flame.

With the new burner we may then pass through the whole series of combustions, from the slowest and most imperfect to those which are most complete and instantaneous. For these latter ones the burner is entirely open, and the theoretical mixture of gas and air is sent complete and quickly into the flame. This, then, acquires calorific effects as powerful as those of the blowpipe. With the city pressure these flames instantly melt small wires of platinum, and copper or iron wires, several millimeters thick, in a few seconds.

Applied to incandescence these burners give excellent results, as is shown by the following figures deduced at the same time in the laboratory :

Pressure.	Hourly Consumption.	Intensity.	Field.
52 mm. (2.05 ins)	104 liters. (3.67 cu. ft.)	11.45 carcels. (109.9 candles).	1 carcel per 9 liters. (29.95 candles per cu. ft.)
30 mm. (1.18 ins.)	87.5 liters. (3.09 cu. ft.)	9.25 carcels. (88.8 candles).	1 carcel per 9.45 liters. (28.74 candles per cu. ft.)
25 mm. (0.98 ins.)	83.5 liters. (2.95 cu. ft.)	8.77 carcels. (84.2 candles).	1 carcel per 9.52 liters. (28.54 candles per cu. ft.)

In practice the carcel-hour uses about 10 liters of gas (27 candles per cubic foot).

The second kind of burner (Fig. 2) is composed similarly of a gas injector opening inside the tuyeres, surmounted by a tube, whose widened extremity is furnished with a metallic gauze. This gauze carries in its center a button facing downwards, so as to cut into the column of ascending gases and direct them without vibration towards

the annular orifice of exit. The air openings are always superimposed in the body of the burner, but are directed at different angles by means of inclined planes so as to obtain a churning of the mixture while forming. This is again revivified at the combustion orifice as in the preceding.

To increase still more the air supply we use a fine pointed gas jet and crown (Fig. 4.) The gas escaping by this crown draws with it the air arriving by the openings, *O*, regulated by the ring. This fluid mass in movement receives then the impulse of the jet *J*, thrown with great force by the salient point in the middle of the crown. In this way the second addition of air, *O'*, becomes very efficient and the mixture is completed under the combined action of the straight jet and the fluid vein enveloping it.

These burners work with all pressures and fit all kinds of mantles. For those of the Auer kind trials have given as average :

Pressure.	Consumption.	Light Power.
22-tenths inches.	5.6 cubic feet.	152 candles.

While we obtain ordinarily only 104 at same pressure and consumption.

This is then a candle hour per liter of gas ; that is to say, a yield quite as favorable as that which we obtain with incandescent systems using compressed gas or forced draft.

Finally, we may increase the draft by causing the jets to work as aids to ventilation as is done in recuperative lamps. Using for this burners of type No. 1, of large size and open, with a long hood, we realize sufficiently intense fires for all applications.

The Injustice of Indirectly Taxing the People While Pretending to Tax Corporations.

By Mr. Austin W. Wright, in *Electrical Engineering.*

Because of the insidious influences of indirect taxation, perverting as it has all thought relating to that subject, there is, in the popular mind, almost no appreciation of what constitutes equity in relation to the proper distribution of the burdens imposed by the cost of supporting the government. And because of undue prejudice and an unreasoning antipathy which prevails among the people, and which is directed toward all corporate activity which is engaged in satisfying popular wants which are general in character, and because of prejudices and antipathies wholly due to causes which have obscured the real benefits which flow from such incorporated associations of capital, there is an almost universal demand that powers of taxation be arbitrarily extended and applied to the earnings of corporations, and it is insisted that no further grants of corporate powers be given to corporations of this kind without exacting what is called suitable compensation therefor, this compensation, at stated times, in all cases, to be paid into the public treasury and used for public purposes. There seems to be an idea that contributions to public funds thus exacted from corporations will lessen the burden of taxation now resting upon the people. Without stopping to inquire into the existing popular antagonism which relates to all associations of capital under corporate forms, and which is the unreasoning sentiment that impels people to make these unjust demands for taxing corporate activity, let us see where it leads.

In consideration of their being granted a franchise conferring a special and an exclusive privilege to perform certain specified activities, together with the enjoyment of such property rights as may arise from the use of the land appropriated for corporate purposes, or the use of streets and alleys over and through which the activity may be conducted, it is proposed that these corporations shall pay into the public treasury either a percentage of their gross receipts or a certain specified sum of money for the opportunity and privilege of performing a service of the kind proposed, the service to be performed for people who need it, and who are to pay the company for its performance. It seems strange that anyone can be so blinded by prejudice that they fail to see that a scheme of this kind, instead of making the corporations thus taxed a source of public revenue, will merely make them channels through which money obtained by them from the people will flow into the public treasury. These corporations will become great zamindars to which will be farmed out the duty of collecting immense sums of money from those of the people whose necessities compel them to patronize the corporation, the corporations being permitted to enjoy the exercise of exclusive proprietary powers, so long as they turn the agreed portion of what they are able to extort from the people into the public treasury—that is, all of the people, acting through the power of a franchise by themselves granted, are to join with the corporation and there by enable it to charge and collect from those whose circumstances oblige them to hire its services a greater sum than could or would otherwise be charged. The people living along the line of the Illinois Central Railroad are to be forever charged a greater price for the services which that railroad performs for them because the State exacts from that corporation 7 per cent. of its gross earnings. Have the people whose circumstances oblige them to hire the services of that corporation any special reason to revere the authority of the great State of Illinois for forever arbitrarily imposing upon them and their posterity such grossly inequitable conditions? What justice is there in obliging all citizens of the United States, yes, all the people of the world, who use that railroad, to pay something toward the expenses of government in Illinois? What just reason is there for exacting from the people of Illinois who use the Illinois Central Railroad a greater portion of the expenses of the State than is required from citizens who do not use that railroad?

What will a tax specially imposed on telegraph and telephone companies mean other than that because of the tax their patrons will be obliged to pay increased rates for the services they receive from those companies? That everybody who uses illuminating gas will, in consequence of the tax, be obliged to pay more for the convenience of having artificial light. The street car is a means of conveyance used by all, but so much more largely by those in moderate or poor pecuniary circumstances, that to them it has become an absolute necessity. What does a tax upon the receipts of street car companies imply? It means that the toiling masses who live in our cities, who ride in the street car, and to whom every additionally expended cent denies to them or theirs some little comfort, perhaps a necessity, shall pay more for their rides to and from their daily work ; it means that the man who carries the dinner pail shall be unnecessarily and unjustly taxed ; it means that the poor struggling, under-paid, ill-clad, half-fed girl, who is trying to support herself, keep respectable and remain virtuous shall be taxed twice each day by being obliged to pay an increased price for her ride in the street car ; it means that because of a foolish popular spite against corporate association of capital, that street car companies will be forever permitted to charge 5 cents for a service that could be profitably performed for 2 cents, and that this charge will be imposed and rest upon that portion of the community that is least able to bear it. It has been said that the poor man was not much inconvenced by a tax of ½ cent on his dinner pail, and we will probably now be told that it will not make much difference to the poor if they do have to pay 2 cents or 3 cents more for each ride in the street car ; that they would be likely to spend the money for beer anyway; but, be that as it may, in any of our great cities where the number of passengers carried annually reach figures running high up into the millions, an overcharge of 2 cents, 1 cent, or even ½ cent per ride amounts in aggregation to a great sum of money wrongfully taken from its rightful owners. Can anybody give one equitable reason why governmental authority, organized that justice may be done among men, should authorize the taking of 2 cents, 1 cent or any part of a cent from anyone, rich or poor, without giving in return a compensating equivalent?

There are many grave errors in the conduct of quasi-public corporations, in relation to those who need their services, from which the people are grievous sufferers, consisting of failure to properly perform the services required, and of various acts of oppressive aggression, but the imposition of a tax which in the very nature of things must rest an additional burden upon the few who are compelled to employ the services of these corporate associations is not a remedy that will cure or even palliate any of them ; it is simply adding another weight to the now existing intolerable load of evil ; reform cannot possibly lie in that direction. These evils are everywhere present among us, because the citizen has failed to look after and take the precaution necessary to protect and safeguard his own rights against the encroachments of corporations. The citizen has failed to do this because of political apathy and because of a weakened sense of *right* in relation to all public duty, due to the enervating and destroying influence of indirect taxation.

The citizen has been deprived of a knowledge of the cost of liberty in so far as it relates to himself, and so he has permitted the granting of improper charters to corporations by which they are enabled to despoil him. The applications of astringents to the external manifestations which we see and feel will simply add to the evil by increasing the virulence of the disease. The fault does not consist in these external eruptions, but is organic, and until this fact is recognized all reformatory effort will fail to bring hoped-for results. Proceeding against bribery, blackmail, or any of the corrupt practices in relation to the methods used by which franchises are obtained from State and municipal legislative bodies, will and must be utterly fruitless. It is because charters containing improper privileges can be obtained that there are

bribers among our best citizens, and bribetakers in our legislatures and councils. Nobody would bribe a legislator or alderman to grant, or an executive officer to approvingly sign, a charter that was eminently proper in every respect. No man acting in a legislative capacity would ever think of selling improper privileges to anybody if he had no power to grant charters containing such privileges. These evidences of moral disease are not mere sporadic manifestations nor are they endemic in character; they cannot be treated specially because they are phenomena arising from a remote generic cause which acts organifically and which has been entirely lost sight of, continuing constantly operative because it remains always untouched.

So long as State and municipal legislatures have power to grant improper charters, somebody will appear, or be induced to appear, to buy them, and the people will be cursed with the effects of official and civic corruption. Men otherwise honest will by force of circumstances be irresistibly impelled to join in the debauching scramble for charters conferring a franchise enabling them to charge more for a service to the people than it is worth. Men of average intelligence do not need to be told that money can be made very easily and very rapidly once monopolistic franchises are obtained. Enterprising men usually have capital, and many of them have inclination to operate railroads, telegraph lines, telephone companies, street cars and gas works, together with the faculty for operating these enterprises intelligently and profitably. They are honest men, but what are they to do? Their characters as honest, enterprising men of affairs will not enable them to obtain a monopolistic charter for the asking; if the charters granted were entirely proper, containing no powers except such as might properly be given to any responsible association of individuals possessing integrity and capital, these men could and would sometimes get them. But where franchises are to be granted containing improper and exclusive grants of power, corrupt influences will and must be used. Must the best citizen stand aside and see himself always and forever barred from any participation in this great and fruitful field of legitimate enterprise? Is it not too much to ask or expect of any man that he shall stand always upon high moral ground simply to be laughed at by his equally enterprising but less scrupulous neighbors while they obtain and enjoy the benefits flowing from franchises full of fat? Few men are made of the stuff that will enable them to bravely deny themselves opportunity of participation in business that they desire to enter, and for which they think themselves fitted, simply because somebody who has the power to grant them the privilege of engaging in the business must be paid before the privilege can be obtained. No man becomes a corruptionist from choice—even those who have no conscientious scruples that can be outraged prefer to do the right thing rather than the wrong thing.

Now and then, while smarting under the lash of public criticism, some prominent public official turns in self-defence and gives utterance to a whining complaint in which he insists that it is the eminently respectable citizen who is always the corrupting influence; that but for the eager rapacity of the best citizen and the malign influence which he ever exercises upon public officials there would be little or no boodling in our legislative bodies. What he says about the best citizen is in a measure true, but he is unaware that himself and the best citizens are each moved to act as they do by a cause that they know not of but which has secretly corrupted all men; so when subjected to strong criticism, the public official, while pointing at eminent respectability, cries out, "There is a blacker blot than I."

In the first place, it is a matter of common notoriety that improper franchises are and can be obtained from these public agencies. When business has become dull, ordinances have actually been passed granting a valuable franchise to men of straw, and the franchise has then been hawked about until purchasers were found. No one can afford to accept franchises containing proper limitations against the exercise of monopolistic privileges and compete with those who obtain franchises containing no such limitations. Who are the best citizens of any community? Are not the most enterprising, the shrewdest, the keenest, the brightest and most capable men in the community its best citizens? Under proper and equitable conditions honest men of enterprise would inevitably control and operate all quasi-public activity. Dishonesty can no more successfully compete with honesty in an open field than error can permanently overthrow right. Men are not by nature prone to be dishonest; it is the force of circumstances that drives them into the use of dishonest methods. Remove the physical cause—that is, cease the subtle subversion of the powers of government, thus making it easier for men to succeed by the use of chicane and artifice than by straightforward methods.

Stop teaching men by example stronger than precept that instead of being an impartially organized administrative agency, the single purpose of which is to secure to all men the unmolested enjoyment of the results of self-exertion, the State has become a means to enable men to obtain inequitable advantage over each other; that instead of affording equal security and dispensing impartial justice it bestows favors enabling a few to feed off the substance of the many. There is a remedy, but it does not consist in the exercise of the taxing power in such a way that the monopoly of these various corporate activities will be made forever secure, provided they agree to become aids in government in extorting greater sums from the earnings of the people than is at present possible, thus encouraging augmentation of public extravagance and waste; there is a remedy, but it does not consist in Draconian measures of regulation; the true remedy is to be found in the opposite direction. It lies in the direction of an enlarged freedom, giving all men opportunity to feel the weight of every responsibility that attaches to gregarious life, thus learning by personal experience, each for himself, the everlasting truth that the enjoyment of benefits flowing from rights inhering to every citizen and the performance of every essential duty belonging to citizenship necessary to the preservation of those rights, must be personally attended to and not to be thoughtlessly surrendered into unfit hands.

The Use of Oxygen in Rescue Work in Collieries.

The *Colliery Guardian* says that in the class of accidents caused by lack of air or by the appearance of poisonous vapors, firedamp explosions with the resulting afterdamp, pit fires and the like occupy an important place, and the first and most important operations in rescue work in connection with such accidents are: (1) The supply of air to the persons in danger, and, if the latter is not feasible; (2) the removal of the sufferers from the seat of the suffocating or poisonous gases into respirable air.

In the first named case, for the supply of fresh air the ventilation of the affected space, or artificial respiration, will frequently—according to the degree of danger existing—be sufficient to rekindle the spark of life, but in many instances a more highly-concentrated air is necessary, and use is therefore made, with the greatest advantage, of oxygen, a substance of which every industrial establishment should hold a supply at hand in case of need. In the numerous establishments owned by the Archduke Friedrich, in Austrian Silesia, stores of liquefied oxygen are kept in steel flasks, and have already been the means of saving many lives. For example, in March of last year the gases of a blast furnace in course of charging, were forced back by a back-draft, stupefying and burning the attendant, who was removed in an unconscious state to the works' hospital. Before medical aid could be obtained, the works' manager introduced pure oxygen through the nose into the lungs of the sufferer, with such beneficial results that not only did he recover consciousness, but was so far strengthened as to be able to proceed home on foot, after his burns had been attended to. In another case, which happened in December, 1896, four men engaged in painting the inside of a boiler with an anti-corrosive liquid, were rendered insensible by the evolved vapors before they could give warning to those outside. The head boiler minder, entering the boiler to ascertain the cause of the silence, was also overcome before he could retreat, and the like fate overtook another workman, so that there were six men lying unconscious in the boiler. After the lapse of several hours, the works' engineer, who was summoned, arrived, and immediately emptied two oxygen bottles (each containing some 220 gallons) into the boiler, whereupon the rattling breathing of the sufferers immediately became apparent, and soon after four of the men crawled out unaided. The other two lay between the wall of the boiler and the heating flue, and to them a supply of 220 gallons of oxygen was delivered through a hose, with the result that in a short time they, too, were able to make their way out, and although they had been exposed to the poisonous atmosphere for some four hours, were fully recovered within a very few days. In a third instance, oxygen restored consciousness, after bleeding, electricity, injections, friction, and attempts at artificial respirations had failed, in the case of a man poisoned by carbonic oxide fumes.

In the apparatus supplied by Dr. Elkan, of Berlin, for use with oxygen from steel storage cylinders, an india-rubber balloon serves for the reception and transport of the gas from the cylinders to the seat of the accident, the gas being then supplied to the unconscious sufferer by way of a rubber pipe terminating in a vulcanite piece, which is inserted into the notrils (not in the mouth, this precaution being necessary on account of the tendency to press the teeth together, exhibited by patients

recovering strength). When one balloon is empty, another full one takes its place. The cost of a cylinder containing a charge of 220 gallons of oxygen, together with the rubber balloon, is only about $15.

It is, however, not always feasible to supply oxygen or air *direct* to the injured, but the latter have to be brought out of the dangerous atmosphere, a proceeding which necessitates the entry of a rescuer into such atmosphere; and as this must be effected as rapidly as possible after the accident, and therefore ventilation cannot be waited for, it is necessary to arm the rescuers with some other appliance to enable them to breathe in the polluted air. Of these appliances there are various kinds, ranging from a simple sponge dipped in vinegar up to complex apparatus, the best kind to use depending on the circumstances of the case. Thus, for remaining at work in irrespirable air for a long time, those appliances wherein a supply of air is delivered to the rescuer through a pipe, will be employed, such as the von Bremen diving suit, or the Muller helmet, the former of which was used, with great advantage, in the prolonged recovery work, after the great catastrophe at Karwin, in June, 1894, and the latter by many Continental fire police.

These appliances, however, take time to set up in working order, and moreover do not permit of the rescuers advancing much farther than 100 yards at most, in addition to which the life of the wearer is absolutely dependent on the efficiency of the man in charge of the air supply and the satisfactory working of the supply pipe.

The form of rescue apparatus is different when it is a question of saving life, and therefore of reaching, directly after an accident, as many as possible of those who still survive, and of bringing them out of the seat of danger and into the care of the doctor. In such case an essential stipulation is that the apparatus should be readily handled, simple in construction, and allow the wearer to proceed to any desired distance independent of any conditions. These desiderata are best complied with in the forms of oxygen apparatus of Schwann, Fleuss and Walcher-Gartner, the last named of which has been proved highly serviceable, both in test cases and in actual rescue work, and its use has recently been made compulsory in the Ostrau-Karwin coal field by an ordinance enacting that at least 5 per cent. of the workers in the pits must be provided with this apparatus (the "pneumatophore.")

In laying down a method of procedure for rescue work, the difficulty is encountered that accidents never happen exactly to pattern, as it were, but each new one presents fresh features and brings new experience. However this may be, the primary task of removing the injured or conveying respirable air to them, remains the same. A single individual engaged in rescue work and armed with a supply of oxygen, whatever the form of (portable) apparatus used, may afford assistance in the latter respect by supplying oxygen to the lungs of the injured, but for purposes of removal cannot accomplish much unaided, owing to the confined space in mine galleries, and frequently the considerable distances to be traversed. It is therefore always advisable for rescuers to work, not singly, but in parties of three or four, for affording mutual assistance in the task in hand. Two men will suffice for carrying an injured comrade, but this should only be resorted to where the distance is short, some means of transport being necessary for longer distances. As in consequence of the accident—fire, explosion, etc.—trucks may not be available, a kind of litter will be necessary, and this can be preferably constructed of planking about 7 feet long and 18 inches wide, the one end rounded and provided with a hook, and the sides having sundry buckled straps fastened on to them. The body or corpse can be quickly strapped on to this conveyance and drawn along the rails or sole by one man, the second pushing behind. The work of rescue is much simpler if the ways are in a state permitting the passage of haulage trucks or barrows, and in either case can be carried on without difficulty by men armed with the pneumatophore.

It may, after a pit accident, be equally necessary to erect barriers and dams, close or rehang ventilating doors, and perhaps also arrange for separate ventilation by providing brattices and tubbings, for which purpose material has to be brought, sawn, hammered, etc. In such event, although by reason of the partial exhaustion of the oxygen supply in the portable apparatus, it may be necessary to suspend work for a time at intervals, apparatus of this kind can nevertheless be advantageously used, particularly when the men are supplied with relays, or work in shifts of suitable length, changing when the oxygen supply gives out.

Speaking of this leads to the question, how the wearer of the apparatus can judge the time the supply will hold out, since even by using a watch and observing the time, it may happen that he penetrates too far into the workings and has an insufficient quantity of oxygen left for his return journey. This problem may be solved in the case of the pneumatophore, by providing each member of the rescue parties with a reserve apparatus for use on the return journey, the comparative lightness (some 8 pounds only) rendering this a by no means insuperable difficulty. Then the exhaustion of the oxygen supply in the first apparatus gives the signal for retreat, there being sufficient breathing time for the second apparatus to be put in position and started in action. In this wise the return journey can be effected with perfect security. Mention of this latter recalls the importance of a special detail of rescue work—viz., the leaving behind of electric lamps and the fitting up of reliable depots with reserve apparatus, refreshments, etc., in the chief roads affording means of escape.

It is also necessary to organize the rescue staff, as is done in the case of fire brigades, and to exercise at intervals in order that when the need arises each one may exactly know what to do and how to do it. The importance of pure oxygen as an agency of rescue work in mines, etc., must be acknowledged, and it seems equally evident that the Walcher portable apparatus fills a gap hitherto existing in the means for bringing this agent into operation in mining work.

Modern Construction and Maintenance of Electric Lines.

At the recent meeting of the Mayors' Convention, held in Columbus, Ohio, Mr. Brophy read a paper, on the subject named in the heading, in the course of which he said:

No one can deny that the best form of electric line construction is the underground system for the transmission of any form of electrical energy, except possibly the long distance telephone system, for here induction and retardation as yet offer an unsurmountable obstacle to the successful transmission of articulate speech over long distance lines when any considerable portion thereof is placed underground.

Electric lighting circuits in which is maintained a difference of potential of from 1,000 to 10,000 volts, can be operated much better than when suspended in the air. The insulation of the underground cables and wires can be maintained at from 1,000 to 6,000 megohms per mile—a figure that cannot be approached by any overhead line except where made up in the form of cables equally well insulated and protected by an outer covering of lead, or some other equally durable material.

In the congested district of cities all electric wires should be placed underground, as there is no excuse now for maintaining them overhead on poles in the streets—an obstruction to travel and a great hindrance to the fire department in the performance of its duties.

Where an underground system is established it should be one pure and simple, not a mongrel one, where the mains and feeders are in the electrical subways and the house services distributed over the face and on the roofs of buildings or on unsightly distribution poles, in order to reach the various customers. There are several objections to this method of construction, one of the principal ones being that it tends to reduce the absolute insulation resistance of the circuit. While the insulation of the underground wires and cables is all that can be desired, that of these portions of the circuits connected thereto that are overhead, is insulated in name only, and neutralizes the good effects of the underground portions of the circuits. All services from underground systems should be continued underground until the interior of the building is reached.

Connections from underground circuits to points of consumption are made in various ways. In some cases subsidiary ducts are laid above the main ducts, in which are placed service wires, and from these connections are readily made to the buildings.

In other cases service connections are made in the manholes, and from there run to the area under the sidewalk, and from these points the consumers are reached. In many cities the mongrel system before mentioned is used, in which case wires are led from underground conductors up the face of buildings to the roofs, there to straggle from one point to another, providing they do not cross the streets. This method should not be tolerated anywhere. It has been the custom up to the present time to place transformers on the outer walls or roofs of buildings, leading the primary wires from the underground circuits to them. A much better plan would be to place them in the manholes or in pits specially prepared for them; this would not expose the high potential primary wires to the accidental touch of firemen and others.

The author then described the two systems of underground electrical service in use—viz., the drawing in and the solid system. For fire and police telegraph circuits the solid system is far superior to any circuit of uninsulated iron wire, and not near as expensive as a drawing in system.

Unfortunately, underground systems as yet are the exception rather than the rule, and most of you for some time to come must deal with the question of overhead lines. In the majority of towns and cities

these lines are running without any system or well defined plan, the aim seeming to be to reach the desired point in the shortest, easiest, cheapest and oftentimes flimsiest manner possible.

Undoubtedly the best system of overhead lines are those supported on tall, shapely poles; on these should be fastened suitable cross arms, with pins for support of petticoat insulators, the lines being fastened to these with tie wires. High and low potential wires should never be placed on the same pole fixture or cross-arm. The pole brackets should not be fastened to the side of a pole between the cross-arms for the support of an extra wire; hard rubber hooks should not be screwed into the underside of a cross-arm for the support of another wire when the arm is already carrying its full quota.

The owners of electric light and power lines make a pretense of using an insulating covering on them, but it is only a pretense; the so-called insulated wire used for overhead circuits of this character is but a flimsy, gauzy sham, so far as insulation is concerned. The insulation resistance of a high potential overhead line should not be less than 15 to 20 megohms per mile, yet I have known them to drop to less than one-half a megohm per mile after a soaking rain, and it is rarely that they reach from 2 to 5 megohms under the most favorable circumstances.

Better by far to use wires without any such coverings and proclaim the fact that they are dangerous and must be left severely alone. But better still would it be to compel the use of the highest grade of insulation on all such wires and protect them from the action of the elements by a suitable mechanical covering, such as lead. The same high grade of insulation can be maintained in overhead lines as is obtained in those placed underground, providing the same class of material is used. How long is the present style of overhead circuits to be tolerated, and who will be the first to insist on the much needed improvement is more than I can tell, but that such a change is needed no one at all conversant with the subject can deny. Almost perfect insulation of overhead and underground line is possible, and all that stands in the way is the added expense and the apathy of the municipal authorities and the public, who good-naturedly suffer great abuse without even a murmur.

Thousands of dollars are spent by municipalities for the best kind of fire and police telegraph apparatus, which, by the way, has been brought to such a degree of perfection that failure to give and receive the proper signals would be almost unknown were the lines on which they are placed so constructed as to convey an unfailing supply of electric energy from one end of the circuit to the other, instead of dropping it by the wayside whenever a change in the atmospheric conditions takes place.

I will now take up the subject of line construction as it exists and is practiced in most municipalities. It is almost a universal practice to claim the top gain of all poles that have been erected for the use of the city or town in which they are located. This practice of placing municipal wires above all others was a very good one previous to the introduction of electric light and other high potential wires, as it reduced the possibility of interference with them due to the breaking of other lines. With the introduction of the electric light the same policy was pursued from motives of economy.

The practice has often proved to be a most decided false economy, and if persisted in will yet lead to serious and disastrous results. It should be discontinued also for the sake of the employes of the fire alarm department, as it exposes them to unnecessary and almost certain danger owing to accidental contact with wires that may or may not be active, as they have no means of knowing their exact condition. Many deaths and injuries have resulted from this cause and I fear there are more to come. In my own city some weeks ago one of the fire alarm linemen received injuries which did not result fatally, yet bid fair to leave him a physical wreck for the rest of his life.

Roof construction is one of the things that should be avoided in the fire or police telegraph system because it is not easily controlled; it cannot be readily inspected; in can be easily tampered with through accident or design. When exposed to coal gas from chimneys, galvanized iron wire is quickly attacked thereby and soon destroyed. One rusty, unsoldered joint will often offer more resistance to the passage of the current than all the instruments in the circuit.

Above all things, bare, uninsulated loops should be avoided in circuits; running such loops should be looked upon as a criminal act, because the instruments contained thereon are liable to be rendered useless at any time by being accidentally cut out.

The time when these lines should be constructed of uninsulated iron wire has long since passed, and it is the duty of every superintendent to so inform the proper authorities, and it is their duty to furnish the means to make the necessary change or bear the consequences.

Copper wire covered with the best grade of insulation and that in turn enclosed in a covering that will protect it from mechanical injury and the action of the elements is the cheapest in the end, as it reduces the cost of producing the necessary electrical energy and insures the correct working of the system at all times and if every mile of these lines could be placed underground, so much the better; at any rate, all that can should be so placed, as underground electrical construction and operation have long since passed the experimental stage. It must be discouraging to the manufacturers of modern fire and police alarm apparatus to hear of repeated failures of the same, when from 85 to 98 per cent. of them are due to line troubles.

In conclusion, I contend that the present form of line construction for fire and police systems is a relic of barbarism and its continuance a crime against the public, because it invites almost inevitable failure at times when such failures mean the unnecessary loss of valuable property, the spread of flames beyond the ability of the department to cope with them, and, worst of all, the loss of human life.

Plants that Give Light by Night.

Scientific American says that the following account of the phosphorescence of plants, which is much more common than most persons imagine, though few have observed it, is contributed to *La Nature* by M. Chas. Marsillon. "The phosphorescent gleam that certain plants and flowers give out in darkness constitutes one of the strangest phenomena of the vegetable kingdom. The illustrious Linnæus was the first to call the attention of the scientific world to this singular phenomenon, which before his time had been unobserved or unknown. While walking in his father's garden on a calm, warm and fine summer night, he was surprised to see a bunch of Tropæolum majus, the common nasturtium, or capucine, that seemed to have flowers that shone with iridescent colors in the midst of the gloom.

"Captivated by the novelty of the spectacle, the future scientist repeated his nocturnal walk many times, and each time he saw the fantastic gleams of the capucine flowers. An electrician of the period, Wilcke, to whom the young Linnæus related his interesting observations, attributed the display to some electric phenomenon, an opinion that was shared by a number of writers who mentioned the curious property.

"Nevertheless, all did not agree on this point. Some were of the opinion that the phosphorescence was merely apparent, and was an optical illusion.

"Numerous other flowers possess the strange property observed in the nasturtium. Among them, the marsh lily, that grows abundantly in the marshes of South Africa, presents the same peculiarities. Erasmus Darwin, who studied this flower closely, regarded it as the most perfect type of phosphorescent vegetables. The assertions of a great number of scientific observers leave no doubt of the fact that certain plants have this singular property of becoming luminous at night.

"A Swedish naturalist, Haggren, carried his love for this new kind of investigation so far as to employ a special watchman to walk about his garden for whole nights and notify him at once of luminous plants and flowers. The scientist was thus able to prove that the phosphorescence was noticed especially after a very sunny day, while it was invisible in rainy weather. The light increased in intensity during July and August. It appeared about half an hour after sunset and vanished at dawn.

"Haggren carried his investigations farther still. He subjected these singular flowers to a microscopic examination to find out whether the phenomenon did not depend on the presence of insects or other organisms. Repeated experiment showed the improbability of this; he found nothing, and concluded that, according to the opinion of Wilcke, the phenomenon had probably an electric origin. He thought, besides, that the pollen of the flower probably played an important part in the production of the light. His opinion seemed to be confirmed by the fact that the flower of the nasturtium, on which he experimented, shone with a brighter light at the time of full florescence.

"Dowden and three other botanists observed the same phenomenon at different times. They reported their observations in the London *Botanical Journal* about 1842. More recently during the past 10 years Canon Russel has reported the same phenomena. His scientific papers prove that the phosphorescence extends to the leaves of certain plants, those of the nasturtium in particular. This scientist thus proved that the light persists even after the leaves have been detached from the parent stem.

"In September, 1891, he wrote to Science Gossip as follows: 'Dur-

ing the evening of June 19, 1889, I was walking in my garden, when, in passing near a marigold, the Calendula officinalis, I was struck with the intense light given out by its flowers. I waited several seconds and observed to my great surprise that the scintillating light seemed to play around the petals. I thought that I was the victim of an ocular illusion; so, to check my own observations, I called several persons and asked them if they saw anything extraordinary.

"'Several exclaimed that they saw little flames dancing around the flowers; others could scarcely distinguish them, and only at rare intervals; others still, in spite of sustained attention, could see nothing remarkable. This is, without doubt, due to the fact that the power of vision varies greatly with observers, the optic nerves being more sensitive with some than with others. The phenomenon, which began to be visible about half-past eight in the evening, lasted a whole hour, with remarkable alternations of great and of decreasing intensity. At certain moments the entire plant became phosphorescent.'

"The fraxinella, or Dictamnus fraxinella, of which there are three varieties in our gardens, the white, the red, and the purple, seems to excel all other phosphorescent flowers or plants in luminous intensity. This plant secretes in abundance an essential oil that in times of great heat spreads in a thin layer over the surface of the flower and then volatilizes, impregnating the surrounding atmosphere with its vapor. This vapor has the property of becoming luminous in darkness, so that the flowers appear to take fire by contact with the surrounding atmosphere.

"A variety of euphorbia, the euphorbia phosphorea, has also, in a very marked degree, the power of becoming phosphorescent during the night, in the heart of the vast Brazilian forests. In this same country, a sort of grass, which the natives call khuskhus, shines, at certain hours of the night, with a bright light. If we are to believe the tales of trustworthy travelers, in some cases horses and other animals browsing on this grass have stopped in surprise to see it suddenly give out light and surround them with flames that envelop their trembling limbs in all directions.

"But if flowers have this strange property in a remarkable degree, other plants among the lichens, mosses and fungi shine with an equally bright light in the same conditions. In the environs of Dresden, especially, there are several coal mines where grows a small species of agaric along the shafts and galleries. It presents to the visitor the appearance of innumerable luminous festoons of changing colors.

"The eminent naturalist Joseph Hooker thinks that the source of this phosphorescence is a slow combustion, without heat, that takes place in the mycelium of the fungi during a continual oxidation of its substance. In northern India, among the agarics that flourish there, there is a cryptogam similar to that of the Dresden mines, and equally luminous.

"The agaricus olearius, a common mushroom of the south of France, grows, as its name indicates, on the bark of the olive, even in its smallest crevices. It makes its appearance as a parasite of this tree, in the month of November, and transforms the trunk of the olive tree into a phosphorescent mass, producing one of the most original effects that can be met with.

"Quite as remarkable as the preceding is the agaricus gardneri, the parasite of a Brazilian palm. Its light, a brilliant yellowish white, may be compared, for intensity and beauty, to that given by the tropical fireflies. Another cryptogam, a native of Borneo, growing like the preceding on various kinds of trees, gives out a light with greenish tints like that of the electric spark. When the natives see this singular light shining in the black night, they flee in terror, believing that they have seen the Evil One.

"We will close by noting the interesting experiments made by Dr. Tulasne on vegetable phosphorescence. He has proved that the light emitted by mushrooms disappears completely in a vacuum or when they are plunged into a vessel that contains only irrespirable gases. He infers from this that, as Hooker asserted, there is a combination between the oxygen of the surrounding atmosphere and a substance peculiar to this plant. Such is the most probable explanation and the one generally held by scientists, of the singular phenomenon presented by phosphorescent plants."

Petroleum Briquettes.

The Austrian *Chemist* reports that in a process for making petroleum briquettes, invented by Herr Joseph Kohlendorfer, of Landshut, Bavaria, the inventor works up the refuse in such manner as to assume the form of a solid substance, easily handled, and constituting a cheap and convenient fuel. About 10 per cent. of soda lye, with about 10 per cent. of any fatty matter—tallow, for instance—is heated in a boiler, either by superheated steam or with exclusion of air; and so much petroleum refuse is then added to the heated mass as to make up 100 parts. The whole is heated, with constant stirring, for about an hour, the time varying with the mode and intensity of heating; but the temperature must never be allowed to reach the boiling point of petroleum, because in that case a large quantity of froth would form. In this incipient state of saponification the mass acquires the property of taking up large quantities of very fluid rock oil; and if this incorporation of the mass should proceed too slowly, or remain incomplete, it may be hastened by the addition of a little soda lye. In a short time the saponification of the grease, with the fixing of the petroleum, will be effected; and the mass thus produced may be run into molds and allowed to cool, when it may be cut into pieces of any desired form. According to the use for which the briquettes are destined, they can, during manufacture, receive the addition of coaldust, sawdust or other refuse; and, if it be desired to obtain a product of less firm consistency, the grease may be entirely or partially replaced by resin or resin acid, the product in either case having a content of more than 80 per cent. of petroleum, more than 90 per cent. of combustible substances, and less than 5 per cent. of incombustible residue.

Hot Water from Street Lamps.

Invention (London, England) remarks that that useful but often scarcely ornamental landmark in our public streets, the lamp post, may shortly have the sphere of its utility considerably widened, as from it may issue not only the light which guides the sometimes erratic footsteps of the belated traveler, but also a stream of water in a heated condition, by which he will be enabled to secure unto himself a cup of fragrant coffee or other delectable liquid. The idea is being taken up by the Pluto Hot Water Syndicate, and at the Crystal Palace recently a large number of guests were shown in practical operation the new process, which, on the face of it, gives promise of the establishment of a useful and important industry. The scheme, which forms a further development of the "slot" machine, has for its basis the utilization of lost heat, and provides for the attachment to an ordinary street gas lamp of an automatic device whereby the waste heat of the lamp is made to supply boiling water, without any interference with the light-giving properties of the lamp. The apparatus attached to the lamp is ornamental as well as ingenious, and anyone, by depositing a cent in the slot, will be able to obtain a gallon of hot water, or, if so desired, water which has reached the boiling point.

The difficulty of transferring the heat at the top of a lamp to the bottom, or vice versa, has been met by a simple automatic device, by which cold water is fed into a spiral coil and superheating chamber placed about 1 foot above the flame. In this the water is converted into steam, which is expelled by its own expansive force through an ordinary deadweight safety valve, down or up a pipe, to the base of the column, or, in a house, to a floor above, where, through coils of iron pipes, it heats the water contained in the reservoir. This reservoir, in the case of an outdoor lamp, is connected with the water main of the street, and by a further ingenious application of the automatic principle, as soon as a gallon is drawn off, the boiler fills again. Due provision has been made against explosion, and after cold water has been introduced there is a boldly printed thermometer to show the would-be purchaser of the next cent's worth the exact temperature within, and the moment that full boiling point is reached.

A question having arisen as to whether the supply would only be provided during the time the gas was alight for street illumination purposes, or whether it would be available all day as well, the syndicate state that owing to the careful packing round the large storage cistern of 40 gallons at the base of the lamp, which would all be boiling at 5 o'clock, they have found by experience that if the gas were turned off for 12 hours the temperature of the 40 gallons would still be about 150°; but their intention is never to turn off the gas day or night, as if they get an average demand of three or four gallons per hour during the daytime it would pay to keep the gas burning, which only costs 1 cent per hour. As there is much more likely to be a demand in excess of the capacity of the apparatus than below it, to meet this they are having applied a gas regulator, by which the cooling of the reserve water by rapid withdrawal would cause a column of mercury to fall, and so turn on additional gas burners capable of doubling the output of hot water.

As the supply of hot water *per se* does not perhaps offer much prospect of adequate remuneration, adjoining each street lamp apparatus,

with its conveniently available supply of hot water, it is proposed to establish another slot machine containing 2 cent's worth of tea, coffee, cocoa and fluid beef done up in packages, so that at any hour of the night a wholesome beverage may be mixed at a total outlay of 3 cents. It is even proposed to go so far as to provide a paper napkin and soap powder, with the aid of which and 1 cent's worth of hot water the traveler who does not mind publicity might perform his ablutions in the streets. It is by no means intended that the invention should be restricted to distinctly public use. It may be carried into the domestic circle, and gallons of hot water provided at an almost nominal cost. So far as its public aspects are concerned the Pluto Syndicate is said to have already obtained licenses for the attachment to street lamps of their apparatus in Liverpool and Nottingham, and from one parish in London—that of St. Martin-in-the-Fields. The public trial of the invention in the metropolis it is hoped will take place before Christmas, and the primary experiment will be made in the neighborhood of Trafalgar Square, London.

The Influence of Accurate Measurements Upon Economic Operation of Electric Plants.

By Mr. Caryl D. Haskins.

In no branch of commerce, save perhaps in some of the industries dependent upon the generation of electrical energy, is it considered sufficient to know only what raw material is used and what revenue is received. Nor is this information actually regarded as sufficient even in these industries. Until very recently, however, there has been no satisfactory method of actually determining how much electrical energy has been produced during any given period.

Many generating stations in the early days followed a system of frequent readings of ammeters and voltmeters, basing their assumptions as to the actual output on the product of coincident readings, multiplied, of course, by the time factor; thus obtaining an approximation of the kilowatt hours output per day and therefore the approximate cost of generation per kilowatt hour. Many, however, abandoned these frequent readings of instruments, feeling that the approximations of true output measurements were too unreliable to be of real value, because of the constant fluctuation of load between readings. The conditions just described are in reality those of yesterday rather than to day, and they existed only up to that time when it became possible to obtain output meters of sufficient capacity to measure in an accurate and proper manner the true output. Such meters as those to which I refer are now readily obtainable and are being rapidly adopted, not only by street railway companies but by lighting companies also. Electrical engineering skill has responded to the needs of the industries to which it is tributary, and standard designs now exist up to capacities as high as 8,000 amperes, whilst special instruments have been designed large enough for 16,000 amperes.

These total output meters are accurate to a high degree, not upon steady and normal loads, but upon rapidly fluctuating loads as well, giving a true account of all energy output through them on loads ranging from 5 per cent. to 6 per cent. of their rated capacity, up to about 15 per cent. above their rated capacity, the reliability of the record being unaffected by the rapidity of fluctuation of current between these points. Knowing the efficiency which is to be expected from the generator, engine and boiler equipments, it is a simple matter to determine just how much coal and water should have been expended for the run of any given day to generate the indicated kilowatt hours output. Thus it not only becomes possible to determine just what it is costing to generate a kilowatt hour, but it also becomes possible to check the inefficiency of the equipment and to locate trivial faults which might otherwise have escaped notice. For example, should the indicated output fall 10 per cent. below what ought reasonably to be expected from the known input of coal and water, an effort would at once be made to determine where the trouble lies, whether in uneven firing of the boilers, ill-set valves on the engine, or some minor fault in the generator. In no other way known to me can this positive means of check upon a generating system be maintained than by the use of total output meters.

Important as is the measurement of the total station output, there is yet another application of positive measurements which, whilst it has been long appreciated by many, has not been applied in practice at all up to the present time, simply because the necessary meter was not available. I refer to the measurement of the energy used daily to operate each car. Every street railway management has realized that a quite large proportion of the total energy generated is wasted by the careless and improper use of the controller and the brake, and where the old rheostat method of control is used the opportunity for waste on the part of the motorman is yet greater. Almost every street railway superintendent makes a different estimate of the percentage of power wasted upon the system under his charge, for there can be no positive knowledge upon this subject nor can the conditions be regarded as at all stable. An average drawn from the opinions which have been expressed to me would, however, indicate that not less than 20 per cent. of the total energy generated is wasted by improper manipulation of the handles upon the part of the motorman. This improper manipulation is due to some extent to ignorance, but more generally to carelessness. A meter has now been designed which will, I believe, change all of these wasteful conditions. This meter is intended for permanent installation upon the car, and its indications show accurately the consumption of energy in kilowatt hours for any desired time.

Grave difficulties surrounded the designing of a satisfactory meter for this purpose, and the perfecting of the device has only been accomplished by sustained effort extending over a long period. It was necessary not only that the meter should be accurate under the extremely unfavorable conditions of heavy vibration and shock to which it has to be exposed, but also that its construction should be of such a character as to endure these rough conditions for long periods without damage to the mechanism and without the impairment of accuracy. Such a meter as that which I have described is now obtainable and has been successfully operated in actual service over an extremely rough piece of track for many months.

Assuming that the energy is actually 20 per cent. of the total, as I believe it to be, it is, I think, fair to expect a saving of at least half the present waste, or 10 per cent. of the whole amount of energy generated, as a result of the knowledge on the part of the motorman that the management has absolute means of ascertaining how much power he uses per run, or per passenger, or per mile. For under this system he cannot fail to realize that the management has in its possession adequate and reliable data upon which to base promotions or encouragement, reprimand or discharge. Many steam railroads have long made a practice of offering annual prizes to the engine crew doing the most work with the least coal and water, and I anticipate that a similar system of reward may be found advantageous and profitable in street railway practice.

Impurities of the Air in Purifying and Regenerating Houses.

The *Gas World* notes, in a summarized report of a series of experiments made by Mr. H. Drehschmidt, Chemist to the Berlin Gas Works, that the experimenter declares:

It has often been affirmed that the air in these houses is detrimental to the workmen; but precise data were wanting. The principal things to consider are ammonia, hydrocyanic acid, sulphureted hydrogen, sulphide of carbon and some other sulphur compounds, and carbonic oxide. The ammonia is practically removed before the gas enters the purifiers; the others are not so. When the purifying oxide is spread out there is no fear of sulphureted hydrogen being liberated, for the sulphide of iron becomes hydrated oxide of iron and free sulphur. Hydrocyanic acid may possibly be given off; and so may bisulphide of carbon and the other sulphur compounds, and any ammonia which had been mechanically retained, but not carbonic oxide, which is not mechanically retained by the oxide, and can only appear at the time of opening the chamber, from the coal gas then present. The samples of air were taken at the level of the workmen's heads, and the following were the results, in volumes per cent.

Hydrocyanic Acid.—With fresh purifying mass (iron oxide, once or twice used) 0.000066 to 0.00012; with mass used 13 or 14 times, 0.00012 at first, sinking to 0.00002 after long exposure. The method used was to pass the air through water containing finely-divided oxide of mercury. This becomes mercury cyanide, the amount of which can then be ascertained. These proportions of hydrocyanic acid do not appear to have any influence upon the health.

Ammonia.—The air is led through dilute acid and the acid then titrated. The ammonia is at first 0.00004 volume per cent., falling to 0.00002. During the emptying of the purifier box the air contained a 0.00041 volume of ammonia per cent. Even this is less than one-hundredth of the least quantity believed to be detrimental.

Sulphur Compounds.—Sulphureted hydrogen; a blackening of lead paper could scarcely be obtained. Bisulphide of carbon and other sulphur compounds amounted to 0.00003 volume per cent., or 0.000085 grain per cubic foot. The limit for health is said to be 0.2 to 0.3 grain per cubic foot.

Carbonic Oxide.—The percentages ran from 0.006 to 0.038 during the emptying of the purifying box. Hempel showed that carbonic oxide had no effect on the health when the percentage is as low as 0.043, and that the limit at which the presence of carbonic oxide is recognizable by means of the spectroscopic examination of the blood of a mouse is 0.03 per cent.

The foregoing experiments show that the impurities in the air are not present in proportions detrimental to health. The peculiar smell on spreading out does not denote any danger to health ; and it is not a bad smell, as compared with those in most chemical processes. The workmen themselves acknowledge that they no not suffer, but grow old and grey amid these conditions.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. H. J. Johnson, of Milwaukee, has been appointed Superintendent of the Fond du Lac (Wis.) Gas Light Company, vice Mr. Thomas J. Murphy, resigned. Mr. Murphy had been connected with the Fond du Lac Company since 1870.

The proprietors of the Bay State Gas Compay, Delaware, through the Treasurer of the Company, Mr. W. H. Miller, announce that they are prepared to redeem the outstanding income bonds (2,000 bonds, of a par value of $1,000 each) at the rate of $1,000 each, provided not less than 1 950 of the bonds are deposited with the Security Trust and Safe Deposit Company, of Wilmington, Del., on or before Jan. 1, 1898. The notification further provides that the Company does not bind itself to redeem any of the bonds unless the specified maximum number is deposited. From our point of view the Bay State Company need have no fear that 1,950 bonds will not be deposited.

The regular quarterly dividend of 1½ per cent. on the shares of the Mutual Fuel Gas Company, of Chicago, is payable on demand.

Prepayment meters are quite popular in Omaha, Neb., particularly with the proprietors of restaurants.

The Chicago *Journal* says that the proprietors of the Cicero Gas Company, and the authorities of the township of Cicero, Ills., are still considering the sale and purchase of the gas plant for operation on municipal account.

Mr. Adam Weber, of the Manhattan Firebrick and Enameled Clay Retort Works, of New York, informs us that shipments of retorts made by him to various points in Canada have elicited pleasing testimonials to their value from those who are there using the Manhattan goods.

The Norfolk *Virginian* says that Judge Watts, of the Hustings Court, recently granted a charter to the Columbia Electric Light and Gas Company, which proposes to manufacture, sell and transmit to consumers, electricity and gas for light, heat and power in the city of Norfolk. The Company is capitalized in $5,000, with the right to in crease it to $100,000. The officers are: Directors, Chas. Adamson, William E. Stokes, Griffin Callahan and J. Walter White ; President, Chas. Adamson ; Secretary and Treasurer, William E. Stokes.

The new gasholder for the Fall River (Mass.) Company, which is located at the foot of Anawan street, was turned over by the contractors (Messrs. Bartlett, Hayward & Co.) and accepted by the Company early this month. It is of the 3-lift order, and will store 750,000 cubic feet.

The following is the text of the report submitted by Director Thompson to the Committee of Philadelphia Councils, in accordance with expressed desire of the Committee to obtain information respecting the probable expenditure necessary to put the Philadelphia gas works in fair condition to meet the gas demands of the city:

"In reply to your request for information and data relative to the amount of money that is necessary to place the several gas plants of the city and the system of distribution in a thorough condition for the manufacture and distribution of gas, I desire to say that this matter has been receiving our attention for some time past, and recently, on September 24, a resolution was passed by Councils asking for information relative to new gas mains, meters, apparatus, etc., necessary to secure the economical manufacture, storage and distribution of 22-candle power gas, required within 3 years from January 1, 1898, consequently we have based our calculations as per statement herewith appended on that period of time.

"In this connection I also desire to state that if the several gas plants of the city were equipped to run at their maximum capacity, we could not manufacture over 20,000,000 feet of coal gas per day. The largest consumption last year in any one day was between 20,000,000 and 21,000,000 cubic feet, and we believe that with the improvements to the system of distribution and the increase of population that consumption will increase very largely within the next three years, and whatever is done to the plants today must be done looking forward to this increase in the consumption.

"I have the honor to enclose a statement showing the estimated cost of what we deem necessary to secure an economical manufacture and proper distribution of gas for a period of three years from January 1, 1898.

"In the brief time allotted to us for the preparation of these statements it has been impossible to make an examination of the old mains, but we have based our estimate upon past experience, and are of the opinion that the average cost for the renewal and repair of old works is not above the minimum.

Mains.

36-in., from Point Breeze Works to Ninth Ward Works	$200,000
20-in., from 25th Ward Works to Chestnut Hill	200,000
20 in., from Allegheny avenue from 22d street to Ridge avenue, to Main street and to Cotton street	60,000
20 in., from Walnut street, from 24th to 34th street, to Wallace street and to Lancaster avenue	50,000
12-in., from 60th street, from Market street to Baltimore avenue, to 58th street, and on South street from 60th to 63d street	25,000
12-in., from Hunting Park avenue, from Germantown avenue to 22d street and to Venango street	8,200
12-in., from Vine street, from 52d street to 63d street	12,000
12-in., from 58th street, from Baltimore to Elmwood avenues and on Elmwood avenue from 58th street to 73d street	35,000
12-in., from Glenwood avenue and Tioga street, from 6th to Front street	4,500
8 in., from 22d street, from North College avenue to Oxford street	2,100
8-in., from Adams road, from 200 feet north of Unity street to Castor road	3,000
6-in., from Castor road, from Adams road to Foulkrod street, and on Foulkrod street from Leiper street to Frankford ave.	2,500
30-in. (pumping) from 25th Ward Works to 9th and Diamond streets holder station	200,000
4 and 6-in. distributing mains, at least	450,000
Overhauling and recaulking street mains, at least	500,000
	$1,752,300

Holders.

1 1,500,000 cubic feet gasholder, to replace an old holder at 9th Ward Works	$100,000
1 500,000 cubic feet gasholder and tank, to replace an old holder of 100,000 cubic feet capacity at Manayunk	30,000
3d lift on two holders, with necessary repairs to old holders, 25th Ward Works	55,000
3d lift to one holder, with necessary repairs to old holder, 9th Ward Works	30,000
3d lift to one holder, with necessary repairs to old holder, Manayunk	15,000
	$230,000

Services.

Overhauling and replacing worn out services, at least	$250,000
New services, at least	300,000
	$550,000

Meters.

New meters	$225,000
Overhauling and repairing meters	150,000
	$375,000

General Improvements.

Three stacks of Flemming benches, with cold air condensers, 25th Ward Works	$204,000
Five charging machines, with necessary appurtenances, 25th Ward Works	40 000
Valve house, fitted up complete, Point Breeze Works	30,000
Remodeling and duplicating exhaust plant, 22d and Market streets	13.000
Increasing purifying plant at 25th Ward Works	70,000
	$357.000
Adding 3,000,000 cubic feet capacity to coal gas plant, 25th Ward Works, and by so doing equalizing the manufacturing capacity of the 25th Ward and Point Breeze Works, in the event that the manufacturing plant at the 9th Ward Works is replaced with a water gas plant at Point Breeze Works	$300,000

The 9th Ward Works should be abandoned for manufacturing purposes, and a plant for the manufacture of water gas established at Point Breeze. It will be necessary to make this a water gas plant if the candle power (22) asked for in the resolution is to be maintained, and will cost from $700,000 to	$800,000

Recapitulation.

Mains	$1,752,300
Holders	230,000
Services	550,000
Meters	375,000
General improvements	357,000
Water gas plant at Point Breeze	800,000
Increase of holder capacity at 22d and Market streets	500,000
Adding 3,000,000 cubic feet capacity to 25th Ward gas works	300,000
	$4,864,300

"If a coal gas plant of 12,000,000 cubic feet capacity were built at Point Breeze (instead of a water gas plant) it would cost about $1,700,000, and would add $900,000 to the above figures.

"The cost of gas in the holder and at the burner will depend upon existing conditions."

THE P. H. & F. M. Roots Company, of Connersville, Ind., inform us that they have perfected arrangements whereby the American Gas Company, of Philadelphia, will have control of the Roots Company's business in the East, not only in respect of exhausters, but in the matter of blowers, etc., as well. The New York city office will be continued in its present location, No. 109 Liberty street, under the direction of Mr. John A. Caldwell.

"WESTERN OBSERVER," writing under date of October 7th, says that Mr. C. M. Keller, of the Columbus (Ind.) Company, has taken the contract to build an electric lighting plant for a village not far from Columbus. "Observer" further states that the plan in Louisville just now seems to be to boom the electric rather than the gas division of the Louisville Gas Company's business. In proof of this he incloses an advertisement that has appeared quite frequently in the Louisville newspapers. The "ad." reads like this—of course, it is printed in display type, well arranged: "Abandon old fogy ways, and use electricity for light and power. It's like discharging a slouchy, awkward servant for a clean, careful one. Saves time, labor and money." Is this an earnest of the capacity of the gentlemen who appointed themselves dictators last summer of the affairs of the Louisville Gas Company? If it is, they might better make a hurried return to first principles.

THE Berlin Iron Bridge Company has been awarded a contract for furnishing and erecting the structural iron work of floor and roof of a cow barn for the Hospital for the Insane at Middletown, Conn. The building is to be 50 feet in width and 200 feet in length. Under a portion of the building will be a cellar for the storage of root crops and farm products in general. The floor of the barn proper over the cellar is to be supported by steel beams and brick arches; and the roof and the interior supports of the stalls are to be of steel. Every precaution has been taken to cause this structure to be fireproof, and to make it an up-to-date, permanent, handy and economical building.

COMING events cast their shadows before; so wrote a great Englishman some years ago. The connection between Scott and Kalamazoo may undoubtedly seem strained, but one needs not much measure of mystical lore to note that the coming of a mortgage on the plant of the Kalamazoo (Mich.) Heat, Light and Power Company is rather in the nature of a shadow on the value of the stock of the named concern. However, on the 9th inst., a real estate and chattel mortgage upon certain property of the Kalamazoo Heat, Light and Power Company, amounting to $25,000, was filed in the City Clerk's office; E. S. Roos being named as Trustee. Our informant adds: "This is a preliminary step to the issuing of $25,000 in bonds, necessary to the carrying on of the business."

THE Grand Rapids (Mich.) Gas Light Company has adopted the plan of arranging with the American Express Company for the collection of consumers' gas bills at certain named points in the city.

THE water gas plant of the Ipswich (Mass.) Gas Light Company is giving good satisfaction. The plant was put in active work early in October, and the system superseded was an oil gas apparatus of the Hanlon-Leadley type.

THE capable Superintendent of the Holyoke (Mass.) Gas Works, Mr. W. H. Snow, was puzzled not long ago by an unaccountable loss of pressure in a certain district, the main pipes through which are not of a diameter any too large for the duty put upon them. Examination in the ordinary way failed to reveal any marked disorder in the affected line, and Superintendent Snow next made a personal survey of the district. In short order he located the cause, which was chargeable to the negligence of a house mover. The latter moved some feet back from its original location a building, neglecting meanwhile to cap the service pipe that had conveyed gas to the building when it had been occupied.

THE proprietors of the Trenton (N. J.) Gas Light Company have announced a reduction of 10 per cent. in the selling rate—from $2 to $1.80 per 1,000 cubic feet.

AT a meeting of the Fitchburg (Mass.) Council part of the business in hand consisted of a discussion of the terms offered by the Fitchburg Gas and Electric Company for the public lighting of the city by means of arc lamps. The Company agreed to maintain arc lamps on the basis of a payment of $110 each, provided a 5-year contract was entered into, the price to be $120 per lamp if the contract was to run for only one year. In the debate Councilman Babbitt opposed the granting of a contract for five years, at $110 per lamp per year, preferring a yearly contract at $120, since he "had it on good authority that within three years the price of electric lighting will be reduced one half through improvements in machinery and methods which must necessarily come." He failed, however, to give either chapter or verse for the faith that is in him. No positive action was taken on the question of awarding the contract.

MR. P. S. FLOREA has been appointed temporary receiver of the Connersville (Ind.) Gas and Electric Company, on the petition of the American Loan and Trust Company, of Boston, the proceedings resting on a claim of default in interest on certain bonded indebtedness.

THE residents of Creston, Ia., are clamoring for a reduction in gas rates, and with justice, too. The ruling rates are: $2.25 per 1,000 on lighting account; $2 on fuel account.

THE Lawrence (Mass.) Company expects to be comfortably at home in its handsome new office quarters in the Shattuck Building by November 1st. No expense has been spared to have the premises completely and suitably arranged for the Company's purposes.

"OF course, everyone remembers that Mr. Frederick H. Shelton, of Chicago, read a paper last May before the Western Gas Association, on the 'Failure of the Commercial Attempts to Supply Fuel Gas in the United States.' In the course of that paper he remarked: 'Bearing in mind that Rapid City and Bridgeport are trying to, and probably will, get out of fuel gas, and that Tacony is not a city plant as ordinarily understood, practically the only Companies in the business to-day, so to speak, are Framingham and Cottage City.' Well, there's but one left, and that struggles on, in its cool location on Martha's Vineyard Island, where I fear the sad sea waves are crooning over its impending doom. To prove there's but one left, according to the cataloguing of Mr. Shelton, I have only to remark that, at a special meeting of the Framingham Gas, Fuel and Power Company, it was voted unanimously to amend the Company's charter so that illuminating gas may be manufactured and distributed. My informant naively says: 'Alterations in the Irving street plant will probably be commenced soon, so that the Company can furnish an enriched product, similar to that used in Boston, Brookline and elsewhere. The new gas will come as an improvement and will be well received in South Framingham. The product will have an improved value for lighting purposes, also for cooking, heating and power.' And he is right.—OBSERVER."

THE Common Council, of Duluth, Minn., has adopted an ordinance (approved the 5th inst.) directing the proprietors of the Prindle Gas Company of that city to have their works in operation within nine months from the approval of said ordinance.

ALLEN SHEWMON and others are endeavoring to secure a franchise for the operation of a gas works in Green Bay, Wis.

THE other day certain newspapers in Westchester county, N.Y., contained accounts of a disastrous fire that occurred on the works of the Eastchester Gas Light Company, of Mount Vernon, N. Y. The story of the "disaster" would lead anyone interested in the property to believe that the property was quite wiped out. The fact is, there was a fire; and the further fact is, the damage was less than $400.

THERE seems to be quite a large demand for the services of engravers these days in preparing plates wherefrom are printed bonds on reorganized gas properties. There are other plates, too, in plenty, from which are printed shares, certain sums of which "go with the bonds." It is to be hoped that the emissions all represent real values.

The Market for Gas Securities.

The market for city gas shares was decidedly dull and inclined to the low side during the week. Consolidated sold as low as 201 and as high as 211, the opening to-day (Friday) having been made at 206 to 208. The stock is very cheap at those figures. Equitable was a trifle easier, and the quotations for Mutual show a marked decline in that security. The nominal quotations are 325 to 350, but it is quite certain that no round amount of stock could be obtained at the named offered price. Other city shares are dull. Brooklyn Union is still in the declining stage, and it looks very tempting at 121⅛ to 123.

Chicago gas was tumbled about in lively fashion, the range in it for the week having virtually been 10 points. The volume of trading in it was tremendous. The new issue in Chicago has been admitted to the Exchange. Bay State is neglected and weak; we, however, look for much better prices in it than those ruling. Western, of Milwaukee, is very much in demand, at 84 to 85. Holders in this security are talking par for it. Lacledes are dull and inclined to weakness, and Detroit is pretty well held, at something over 48.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

October 18.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	207	208
Central	500,000	50	195	..
" Scrip	220.000	..	100	.
Equitable	4,000,000	100	280	290
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	325	350
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150.000	50	85	.
" Bonds.	150,000	1,000	.	98
New York and East River	5,000,000	100	80	83
Preferred	2,000,000	100	109	111
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106⅛
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	.	.
Standard	5,000,000	100	133	135
Preferred	5,000,000	100	140	145
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	121⅛	123
" " Bonds (5's)	15 000,000	1,000	113¾	114
Bay State	35,000,000	50	6⅛	6¼
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	93	..
2d " " "	3,000,000	1,000	80	81
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	93⅛	94
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650.000	1,000	104	104¼
Columbus	1,069,000	.	93¼	93½
1st Mortgage	1,085.000	..	..	96
Consumers. Jersey City	2,000,000	100	73	80
" Bonds	600,000	1,000	103	105
Cincinnati G. & C. Co.	8,500,000	100	201	202
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	.	.
Consolidated, Baltimore	1,000,000	100	58¼	59¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000		48	50
" Con. Bonds	4,312,000	..	93	94
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	81	85
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	.	145
Indianapolis	2,000,000	..	118	125
" Bonds, 6's	2,650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	86	88
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	.	..
Laclede, St. Louis	7,500,000	100	42	42½
Preferred	2,500,000	100	90	95
Bonds	9,034,400	1,000	101	101½
Little Falls, N. Y.	50.000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	.	128	130x
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	.	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150.000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10.000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	30	33
Bonds	1,000 000		98	100
Washington, D. C.	2,000,000	20	250	.
Western, Milwaukee	4,000,000	100	84	85
Bonds, 5's	3,556,000	.	98	100
Wilmington, Del.	590,000	50	200	202

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Connelly Iron Sponge and Governor Co., New York City 627

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Ludlow Valve Manufacturing Co., Troy, N. Y. 626
Chapman Valve Manufacturing Co., Boston, Mass..... 626
R. D. Wood & Co., Phila., Pa..... 634
Continental Iron Works, Brooklyn, N. Y..... 634
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Isbell-Porter Co., New York City..... 634
The Western Gas Construction Co., Fort Wayne, Ind.... 626

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The American Gas Engine Co., Phila., Pa..... 631
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PURIFIER SCREENS.
John Cabot, New York City..... 618

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American Meter Co., New York and Philadelphia..... 638
Maryland Meter and Manufacturing Co., Baltimore, Md. 638
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Wm. M. Crane & Co., New York City..... 618

INSTANTANEOUS WATER HEATERS.
Gilbert & Barker Mfg. Co., New York City 617

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J. P. Whittier, Brooklyn, N. Y..... 626

GASHOLDERS.
Bartlett, Hayward & Co., Baltimore, Md..... 633
Continental Iron Works, Brooklyn, N. Y..... 584
Delly & Fowler, Philadelphia, Pa..... 936
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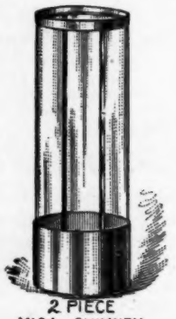

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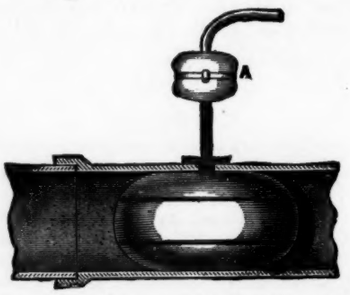

These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficiently inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

3-in. Gas Bag, each,	$0.60		12-in. Gas Bag, each,		$5.00
4 " " "	.80		16 " " "		8.25
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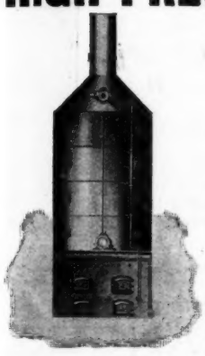

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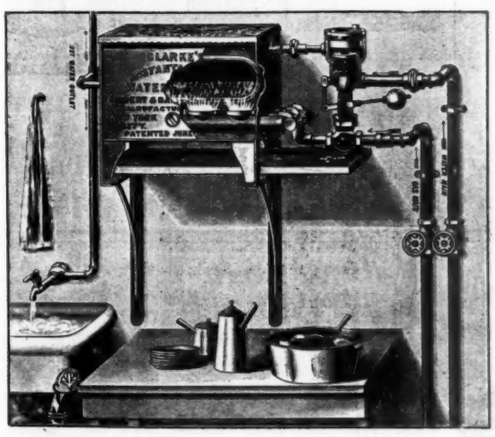

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This Heater furnishes water heated as it flows. The act of drawing water from any faucet with which it is connected automatically turns on the gas, which is in the same way instantly shut off when the flow of water is stopped at the faucet. It will deliver a gallon of water a minute as long as required, at a temperature 80° higher than it is delivered to the Heater; or it will deliver a less amount at a higher temperature, or a greater amount at a lower temperature, as may be determined by regulating the flow at a faucet. We have testimonial letters from those using it in Private Residences, Factories, Barber Shops, Restaurants, Stables, Laboratories, Stores, Churches, Commercial Buildings (for scrubbing), Banks, Clubs (baths, shower baths and sprays), Hotels, Riding Academies (baths and shower baths), and Patrol Stations

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and everything pertaining to the use of Gas.

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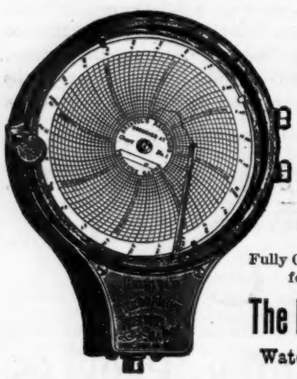

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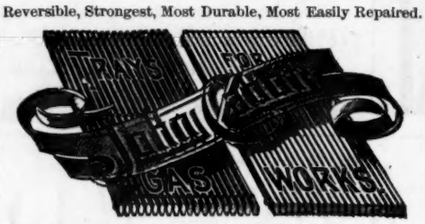

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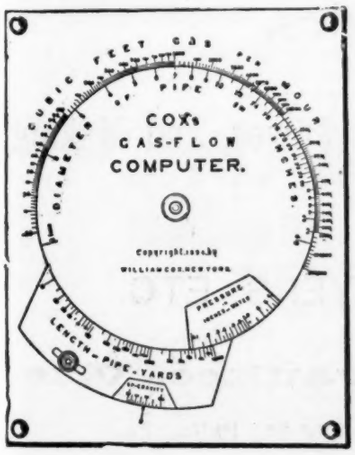

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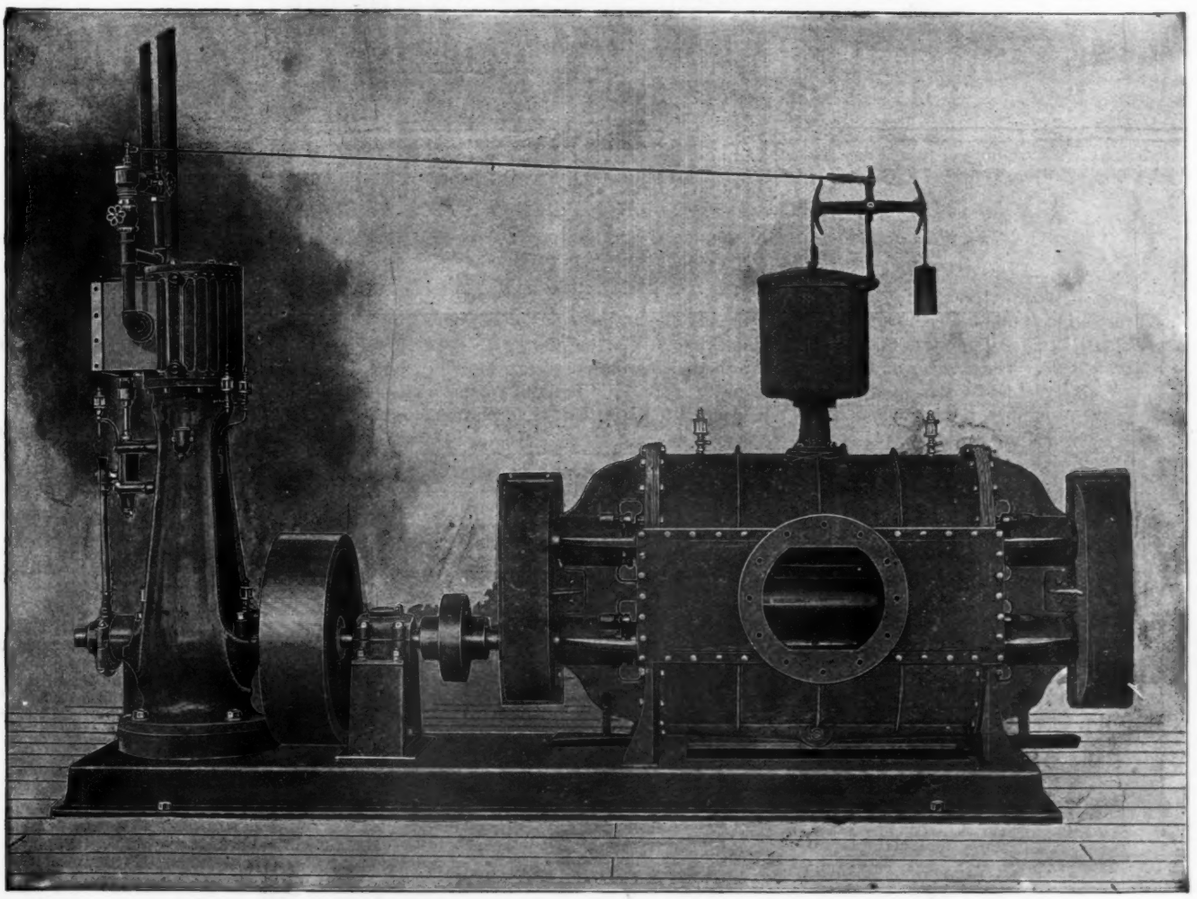

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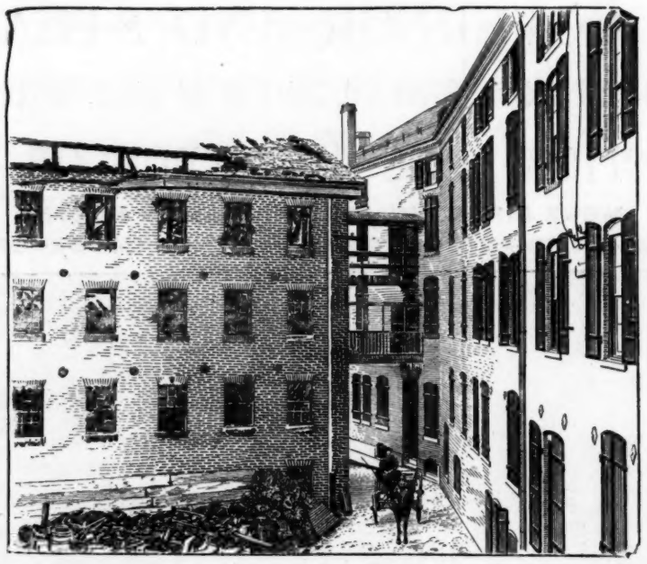

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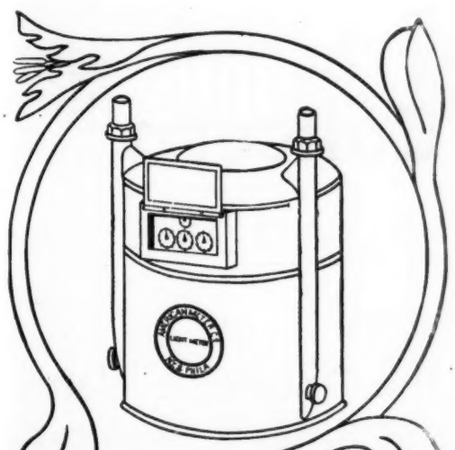

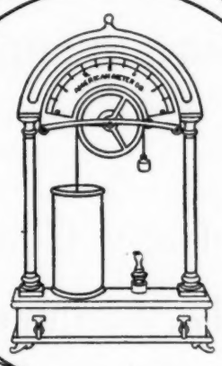

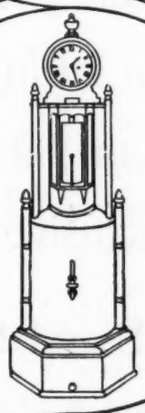

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NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

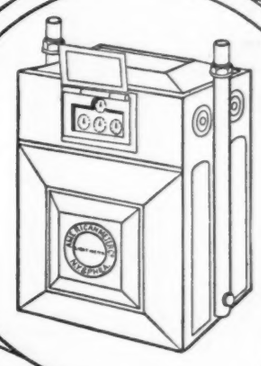
PUBLIC LIGHTING TABLE.

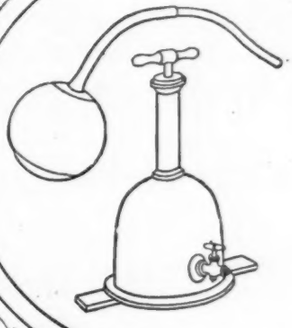
NOVEMBER, 1897.

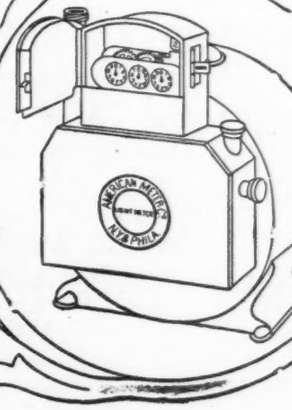
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M
Mon.	1	10.40 PM FQ	5.30 AM	4.45	5.35
Tue.	2	11.50	5.30	4.45	5.35
Wed.	3	12.50 AM	5.30	4.45	5.35
Thu.	4	1.50	5.30	4.45	5.35
Fri.	5	3.00	5.30	4.40	5.45
Sat.	6	4.00	5.30	4.40	5.45
Sun.	7	No L.	No L.	4.40	5.45
Mon.	8	No L. FM	No L.	4.40	5.45
Tue.	9	No L.	No L.	4.40	5.45
Wed.	10	5.20 PM	6.20 PM	4.40	5.45
Thu.	11	5.20	7.00	4.40	5.45
Fri.	12	5.20	7.50	4.30	6.00
Sat.	13	5.20	8.50	4.30	6.00
Sun.	14	5.10	9.50	4.30	6.00
Mon.	15	5.10	10.50	4.30	6.00
Tue.	16	5.10	12.00 AM	4.30	6.00
Wed.	17	5.10 LQ	1.00	4.30	6.00
Thu.	18	5.10	2.10	4.30	6.00
Fri.	19	5.10	3.20	4.25	6.00
Sat.	20	5.10	5.50	4.25	6.00
Sun.	21	5.10	6.00	4.25	6.00
Mon.	22	5.10	6.00	4.25	6.00
Tue.	23	5.10 NM	6.00	4.25	6.00
Wed.	24	5.10	6.00	4.25	6.00
Thu.	25	5.10	6.00	4.25	6.00
Fri.	26	5.10	6.00	4.20	6.10
Sat.	27	5.10	6.00	4.20	6.10
Sun.	28	8.30	6.00	4.20	6.10
Mon.	29	9.40	6.00	4.20	6.10
Tue.	30	10.40 FQ	6.00	4.20	6.10

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45







To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

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Year.	No. of Sets.	Daily Capacity.
1883	2	900,000 Cubic Feet.
1885	5	2,250,000 "
1886	8	2,650,000 "
1887	11	5,200,000 "
1888	5	2,450,000 "
1889	12	3,575,000 "
1890	21	10,050,000 "
1891	31	22,875,000 "
1892	25	15,575,000 "
1893	20	9,875,000 "
1894	22	10,525,000 "
1895	23	12,300,000 "
1896	30	19,550,000 "
1897	21	9,425,000 "

Total Number of Sets - 236

Total Daily Capacity - 127,200,000 Cu. Ft.

Total Annual Capacity, 46,428,000,000 Cu. Ft.

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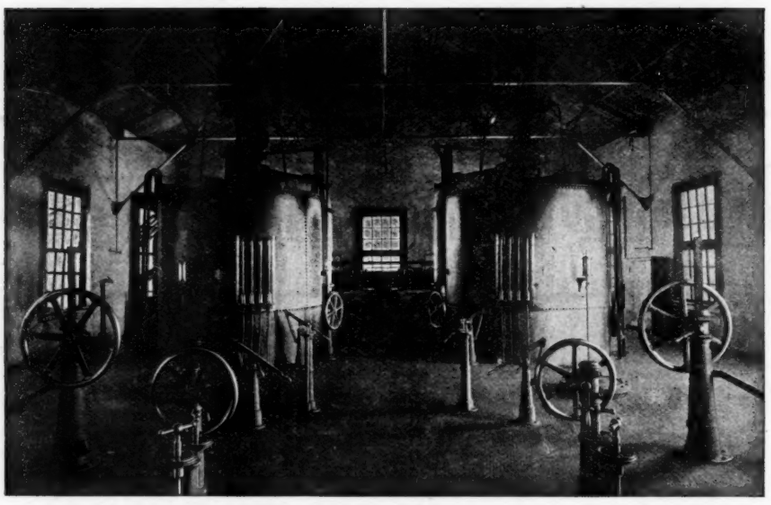

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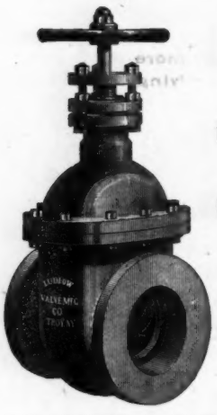

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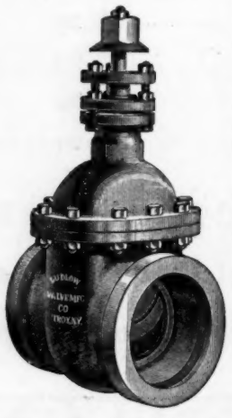

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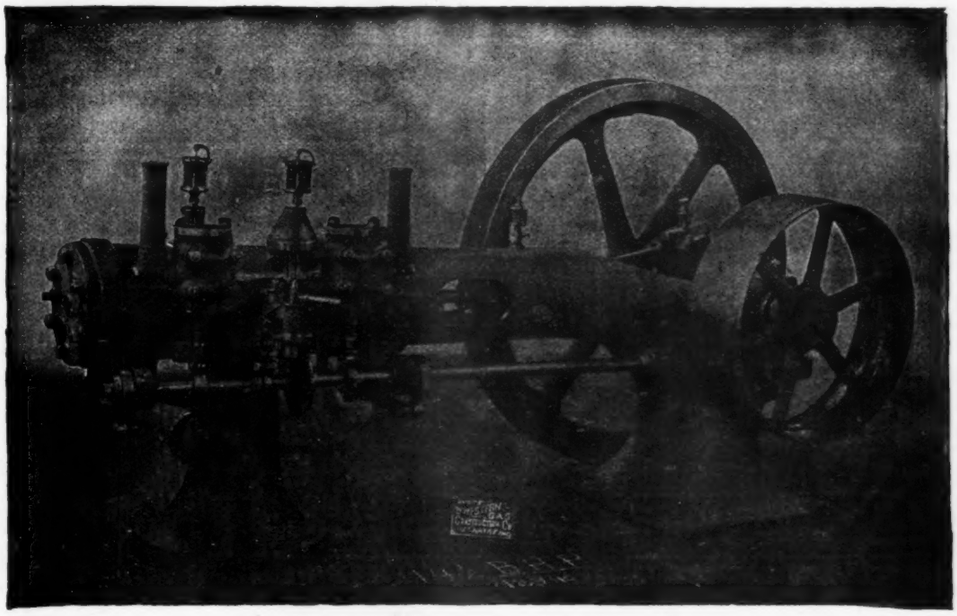

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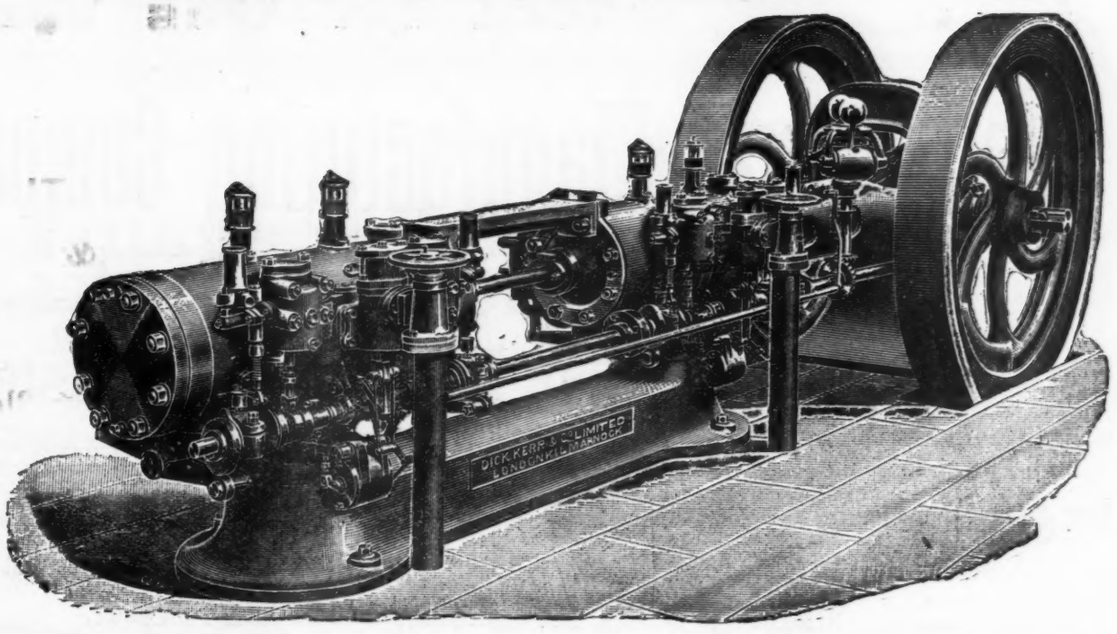

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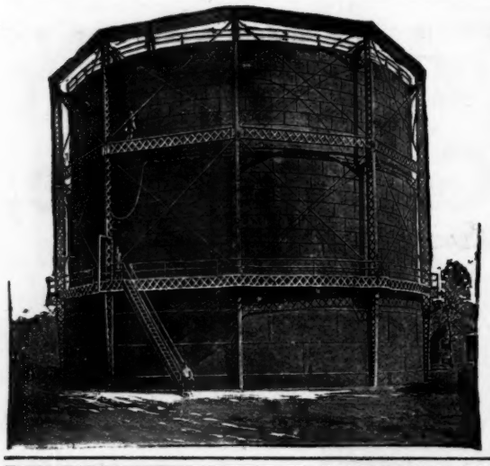

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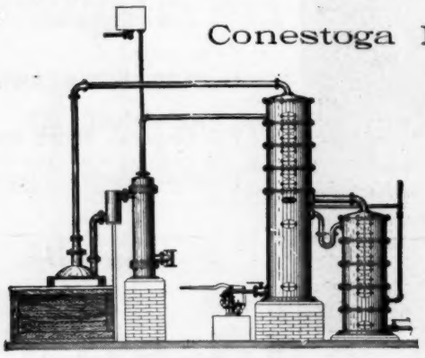

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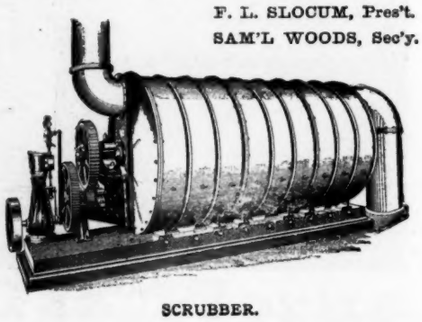

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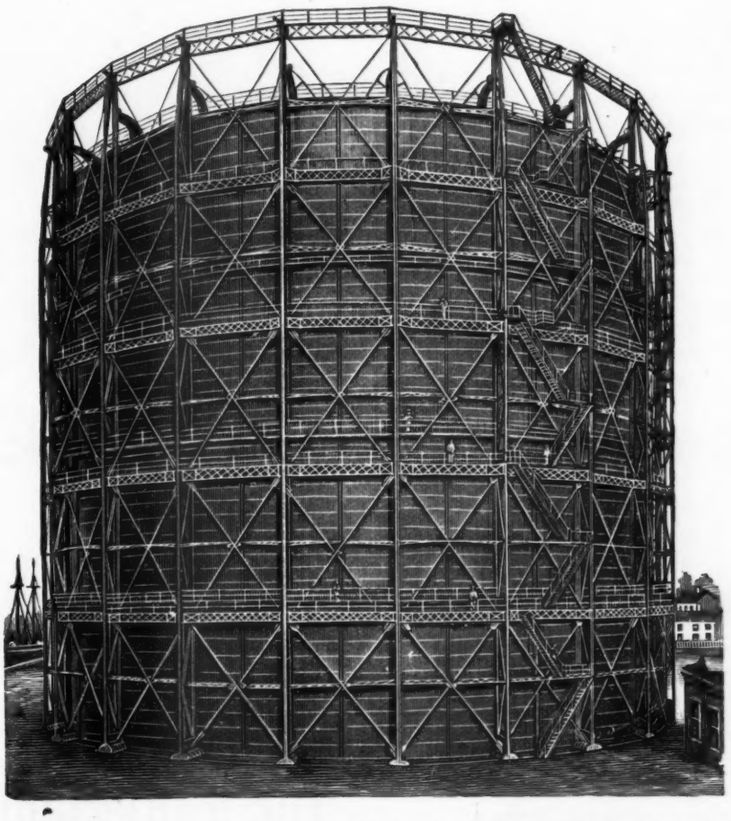

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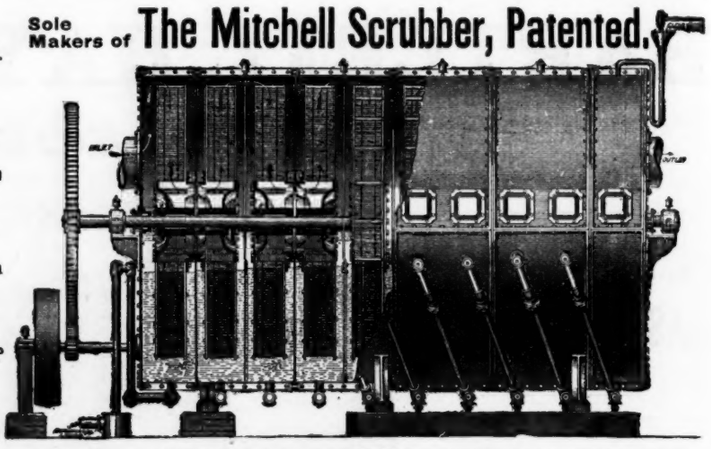

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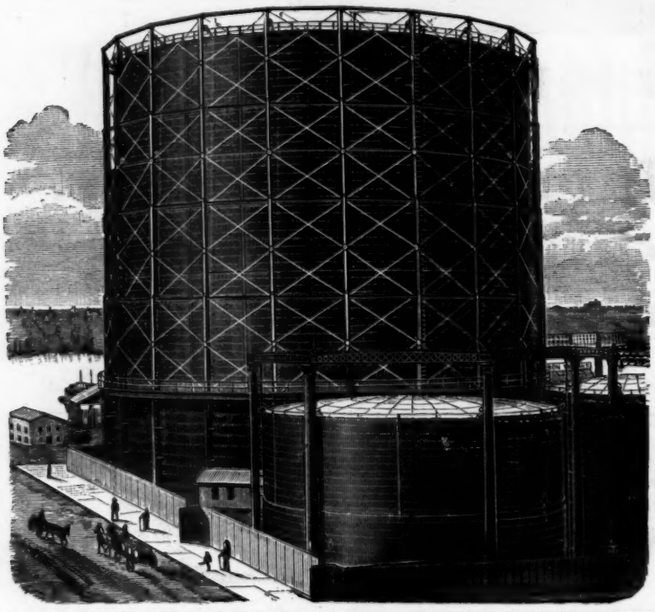

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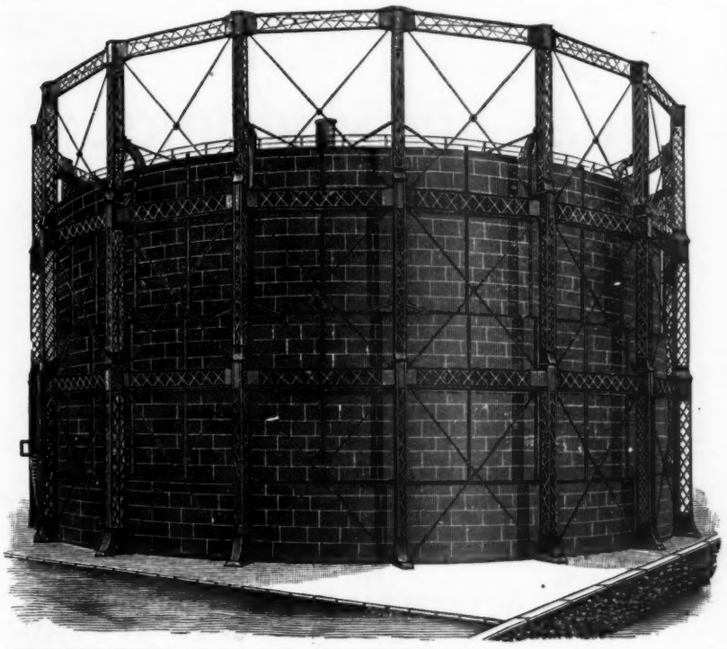

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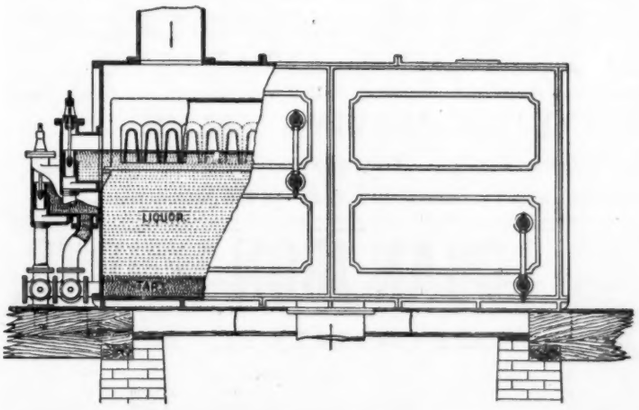

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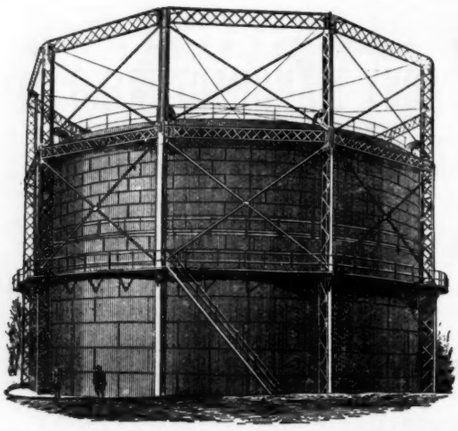

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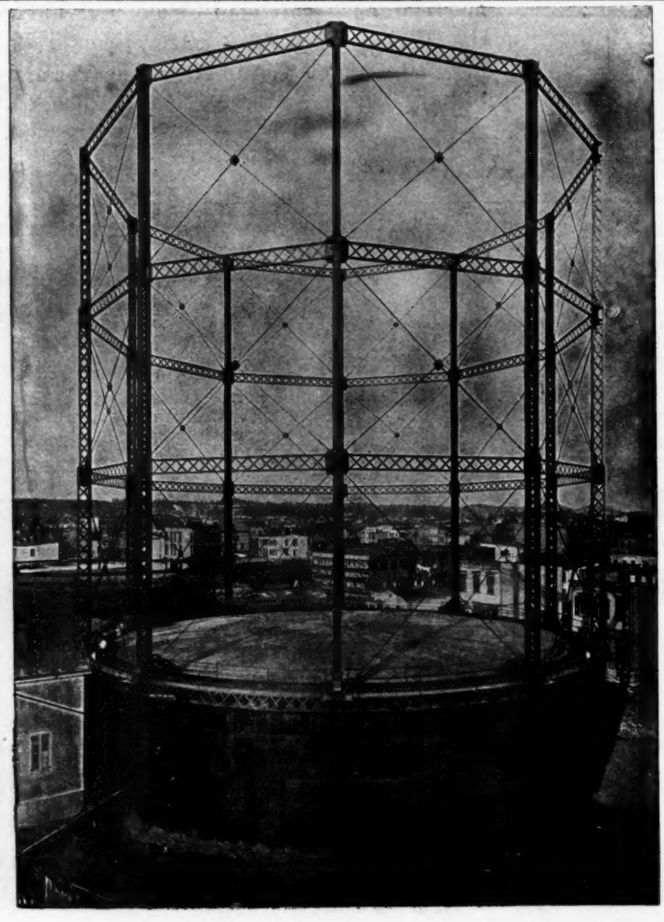

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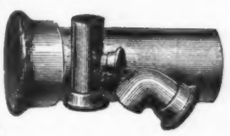

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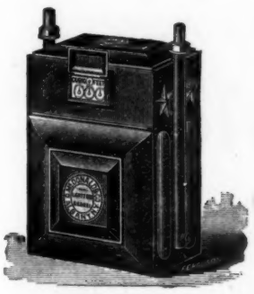

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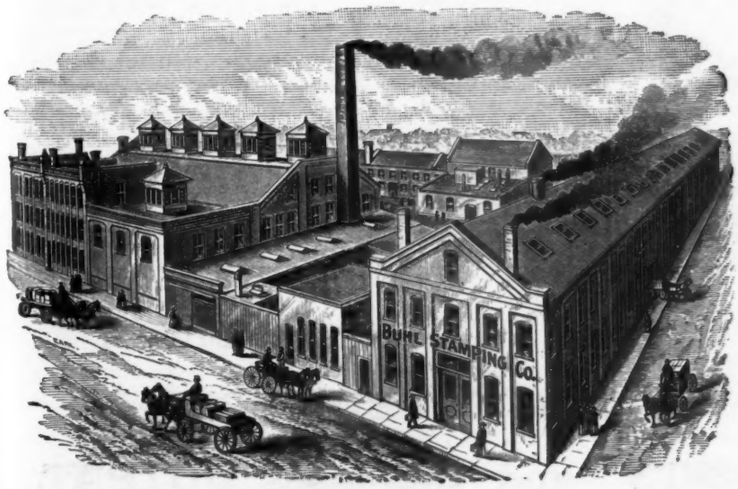

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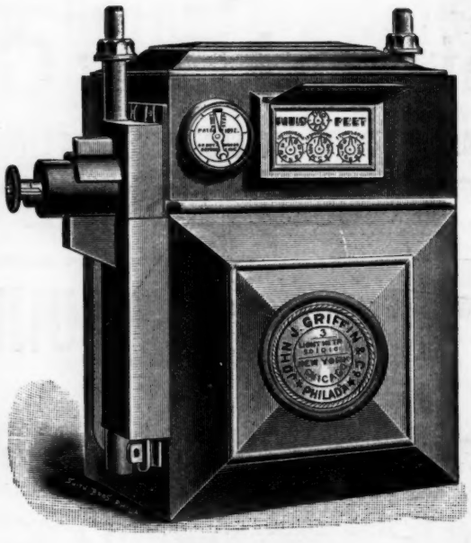

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